



SEQUENCE LISTING

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<118> BRILES et al.

<120> PNEUMOCOCCAL SURFACE PROTEIN C (PSPC), EPITOPIC REGIONS
AND STRAINS THEREOF AND USES THEREFOR

<130> 454312-3140

<140> 09/298,523

<141> 1999-04-23

<160> 77

<170> PatentIn Ver. 2.1

<210> 1

<211> 691

<212> PRT

<213> Streptococcus pneumoniae

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Gly	Val	Val	His	Ala	Glu	Gly	Val	Arg	Ser	Gly	Asn	Asn	Leu	Thr	Val
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Thr	Ser	Ser	Gly	Gln	Asp	Ile	Ser	Lys	Lys	Tyr	Ala	Asp	Glu	Val	Glu
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Ser	His	Leu	Glu	Ser	Ile	Leu	Lys	Asp	Val	Lys	Lys	Asn	Leu	Lys	Lys
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Val	Gln	His	Thr	Gln	Asn	Val	Gly	Leu	Ile	Thr	Lys	Leu	Ser	Glu	Ile
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Lys	Lys	Lys	Tyr	Leu	Tyr	Asp	Leu	Lys	Val	Asn	Val	Leu	Ser	Glu	Ala
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Glu	Leu	Thr	Ser	Lys	Thr	Lys	Glu	Thr	Lys	Glu	Lys	Leu	Thr	Ala	Thr
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Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	Leu	Pro	Thr	Glu	Pro	Glu	Lys	Lys
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Val	Ala	Glu	Ala	Gln	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu
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Asp	Gln	Lys	Glu	Lys	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys
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Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala
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 Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Lys Arg Lys
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 Glu Gln Asp Lys Pro Lys Arg Arg Ala Lys Arg Gly Val Ser Gly Glu
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 Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser
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 385 390 395 400
 Ala Lys Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
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 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
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 Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Ala Lys Glu Lys Val Glu
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 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg
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Leu	Ser	Lys	Leu	Glu	Glu	Leu	Ser	Asp	Lys	Ile	Asp	Glu	Leu	Asp	Ala
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Glu	Ile	Ala	Lys	Leu	Glu	Val	Gln	Leu	Lys	Asp	Ala	Glu	Gly	Asn	Asn
			580					585					590		
Asn	Val	Glu	Ala	Tyr	Phe	Lys	Glu	Gly	Leu	Glu	Lys	Thr	Thr	Ala	Glu
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Asp	Glu	Pro	Glu	Thr	Pro	Ala	Pro	Ala	Pro	Gln	Pro	Ala	Pro	Ala	Pro
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Glu	Lys	Pro	Ala	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro
				645					650					655	
Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro
			660					665					670		
Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Thr	Pro	Glu	Thr
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Pro	Lys	Thr													
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<211> 707

<212> PRT

<213> Streptococcus pneumoniae

<400> 2

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Gly	Val	Val	His	Ala	Glu	Gly	Val	Arg	Ser	Gly	Asn	Asn	Leu	Thr	Val
			35				40					45			

Thr	Ser	Ser	Gly	Gln	Asp	Ile	Ser	Lys	Lys	Tyr	Ala	Asp	Glu	Val	Glu
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Ser	His	Leu	Glu	Ser	Ile	Leu	Lys	Asp	Val	Lys	Lys	Asn	Leu	Lys	Lys
			65			70					75				80

Val	Gln	His	Thr	Gln	Asn	Val	Gly	Leu	Ile	Thr	Lys	Leu	Ser	Glu	Ile
				85					90					95	

Lys	Lys	Lys	Tyr	Leu	Tyr	Asp	Leu	Lys	Val	Asn	Val	Leu	Ser	Glu	Ala
			100					105						110	

Glu	Leu	Thr	Ser	Lys	Thr	Lys	Glu	Thr	Lys	Glu	Lys	Leu	Thr	Ala	Thr
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115					120					125					
Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	Leu	Pro	Thr	Glu	Pro	Glu	Lys	Lys
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Val	Ala	Glu	Ala	Gln	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu
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Asp	Gln	Lys	Glu	Lys	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys
				165					170					175	
Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala
			180					185					190		
Glu	Leu	Glu	Leu	Val	Lys	Val	Lys	Ala	Lys	Glu	Ser	Gln	Asp	Glu	Glu
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Lys	Ile	Lys	Gln	Ala	Glu	Ala	Glu	Val	Glu	Ser	Lys	Gln	Ala	Glu	Ala
	210					215					220				
Thr	Arg	Leu	Lys	Lys	Ile	Lys	Thr	Asp	Arg	Glu	Glu	Ala	Lys	Arg	Lys
225					230					235					240
Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala	Val	Glu	Lys	Asn	Val	Ala	Thr	Ser
				245					250					255	
Glu	Gln	Asp	Lys	Pro	Lys	Arg	Arg	Ala	Lys	Arg	Gly	Val	Ser	Gly	Glu
			260					265					270		
Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser
		275					280					285			
Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Asn	Met	Ala	Asn
			290			295					300				
Glu	Ser	Gln	Thr	Glu	His	Arg	Lys	Asp	Val	Asp	Glu	Tyr	Ile	Lys	Lys
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Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Gly	Arg	Lys	His	Thr	Pro	Asn	Val
				325					330					335	
Asn	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu
			340					345					350		
Leu	Ser	Val	Leu	Lys	Glu	Asn	Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys
			355				360					365			
Thr	Lys	Ala	Glu	Leu	Thr	Ala	Ala	Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr
			370			375					380				
Leu	Lys	Pro	Glu	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu
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Ala	Lys	Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr
				405					410					415	
Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp
			420					425					430		
Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Asn
			435				440					445			

Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Ala Lys Glu Lys Val Glu
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 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg
 465 470 475 480
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 Gly Leu Arg Ala Pro Leu Gln Ser Lys Leu Asp Thr Lys Lys Ala Lys
 545 550 555 560
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 565 570 575
 Glu Ile Ala Lys Leu Glu Val Gln Leu Lys Asp Ala Glu Gly Asn Asn
 580 585 590
 Asn Val Glu Ala Tyr Phe Lys Glu Gly Leu Glu Lys Thr Thr Ala Glu
 595 600 605
 Lys Lys Ala Glu Leu Glu Lys Ala Glu Ala Asp Leu Lys Lys Ala Val
 610 615 620
 Asp Glu Pro Glu Thr Pro Ala Pro Ala Pro Gln Pro Ala Pro Ala Pro
 625 630 635 640
 Glu Lys Pro Ala Glu Lys Pro Ala Pro Ala Pro Ala Pro Glu Lys Pro
 645 650 655
 Ala Pro Ala Pro Glu Lys Pro Ala Pro Ala Pro Glu Lys Pro Ala Pro
 660 665 670
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<210> 3
 <211> 711
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 3
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Phe	Ser	Ile	Gly	Val	Ala	Ser	Val	Val	Val	Ala	Ser	Leu	Val	Met	Gly	20	25	30
Ser	Val	Val	His	Ala	Thr	Glu	Asn	Glu	Gly	Ile	Thr	Gln	Val	Ala	Thr	35	40	45
Ser	Tyr	Asn	Lys	Ala	Asn	Glu	Ser	Gln	Thr	Glu	His	Arg	Lys	Ala	Ala	50	55	60
Lys	Gln	Val	Asp	Glu	Asp	Ile	Lys	Lys	Met	Leu	Ser	Glu	Ile	Gln	Glu	65	70	75
Tyr	Ile	Lys	Lys	Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Lys	Arg	Lys	His	85	90	95
Thr	Gln	Asn	Val	Asn	Leu	Asn	Arg	Lys	Leu	Ser	Ala	Ile	Gln	Thr	Lys	100	105	110
Tyr	Leu	Tyr	Glu	Leu	Arg	Val	Leu	Lys	Glu	Lys	Ser	Lys	Lys	Glu	Glu	115	120	125
Leu	Thr	Ser	Lys	Thr	Lys	Lys	Glu	Leu	Asp	Ala	Ala	Phe	Glu	Lys	Phe	130	135	140
Lys	Lys	Glu	Glu	Pro	Glu	Leu	Thr	Lys	Lys	Leu	Ala	Glu	Ala	Lys	Gln	145	150	155
Lys	Ala	Lys	Ala	Gln	Lys	Glu	Glu	Asp	Phe	Arg	Asn	Tyr	Pro	Thr	Asn	165	170	175
Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Phe	Asp	Val	Lys	Val	180	185	190
Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Pro	Arg	Asn	195	200	205
Glu	Glu	Lys	Ile	Lys	Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Lys	Lys	Ala	210	215	220
Glu	Ala	Thr	Arg	Leu	Glu	Glu	Ile	Lys	Thr	Glu	Arg	Lys	Lys	Ala	Glu	225	230	235
Glu	Glu	Ala	Lys	Arg	Lys	Ala	Glu	Glu	Ser	Glu	Lys	Lys	Ala	Ala	Glu	245	250	255
Ala	Lys	Gln	Lys	Val	Asp	Thr	Lys	Glu	Gln	Gly	Lys	Pro	Lys	Arg	Arg	260	265	270
Ala	Lys	Arg	Gly	Val	Ser	Gly	Glu	Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	275	280	285
Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	290	295	300
Ser	Pro	Ser	Leu	Asn	Ala	Met	Ala	Asn	Glu	Ser	Gln	Thr	Glu	His	Arg	305	310	315
Lys	Asp	Val	Asp	Glu	Tyr	Ile	Lys	Lys	Met	Leu	Ser	Glu	Ile	Gln	Leu	325	330	335

Asp	Arg	Arg	Lys	His	Thr	Gln	Asn	Val	Asn	Leu	Asn	Ile	Lys	Leu	Ser	340	345	350	
Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu	Leu	Ser	Val	Leu	Lys	Glu	Asn	355	360	365	
Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys	Thr	Lys	Ala	Glu	Leu	Thr	Ala	370	375	380	
Ala	Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	Leu	Lys	Pro	Glu	Lys	Lys	Val	385	390	395	400
Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Lys	Asp	405	410	415	
Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	420	425	430	
Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Lys	Val	Lys	Lys	Ala	Glu	435	440	445	
Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Asn	Glu	Ser	Arg	Asn	Glu	Glu	Lys	450	455	460	
Ile	Lys	Gln	Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	465	470	475	480
Arg	Leu	Glu	Lys	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	485	490	495	
Lys	Arg	Lys	Ala	Glu	Glu	Ser	Glu	Lys	Lys	Ala	Ala	Glu	Ala	Lys	Gln	500	505	510	
Lys	Val	Asp	Ala	Glu	Glu	Tyr	Ala	Leu	Glu	Ala	Lys	Ile	Ala	Glu	Leu	515	520	525	
Glu	Tyr	Glu	Val	Gln	Arg	Leu	Glu	Lys	Glu	Leu	Lys	Glu	Ile	Asp	Glu	530	535	540	
Ser	Asp	Ser	Glu	Asp	Tyr	Leu	Lys	Glu	Gly	Leu	Arg	Ala	Pro	Leu	Gln	545	550	555	560
Ser	Lys	Leu	Asp	Thr	Lys	Lys	Ala	Lys	Leu	Ser	Lys	Leu	Glu	Glu	Leu	565	570	575	
Ser	Asp	Lys	Ile	Asp	Glu	Leu	Asp	Ala	Glu	Ile	Ala	Lys	Leu	Glu	Val	580	585	590	
Gln	Leu	Lys	Asp	Ala	Glu	Gly	Asn	Asn	Asn	Val	Glu	Ala	Tyr	Phe	Lys	595	600	605	
Glu	Gly	Leu	Glu	Lys	Thr	Thr	Ala	Glu	Lys	Lys	Ala	Glu	Leu	Glu	Lys	610	615	620	
Ala	Glu	Ala	Asp	Leu	Lys	Lys	Ala	Val	Asp	Glu	Pro	Glu	Thr	Pro	Ala	625	630	635	640
Pro	Ala	Pro	Gln	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Glu	Lys	Pro	645	650	655	

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Thr Pro Glu Thr Pro Lys Thr
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<213> Streptococcus pneumoniae

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35 40 45

Ser Asn Met Ala Lys Thr Glu His Arg Lys Ala Ala Lys Gln Val Val
50 55 60

Asp Ile Lys Lys Met Leu Ser Glu Ile Gln Glu Tyr Ile Lys Lys Met
65 70 75 80

Leu Ser Glu Ile Gln Leu Asp Lys Arg Lys His Thr Gln Asn Val Asn
85 90 95

Leu Asn Arg Lys Leu Ser Ala Ile Gln Thr Lys Tyr Leu Tyr Glu Leu
100 105 110

Arg Val Leu Lys Glu Lys Ser Lys Lys Glu Glu Leu Thr Ser Lys Thr
115 120 125

Lys Lys Glu Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr Leu
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Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu Ala
145 150 155 160

Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro
165 170 175

Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp Val
180 185 190

Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu
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Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu Ser
210 215 220

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 245 250 255
 Ala Ala Glu Ala Lys Gln Lys Val Asp Thr Lys Glu Gln Gly Lys Pro
 260 265 270
 Lys Arg Arg Ala Lys Arg Gly Val Ser Gly Glu Leu Ala Thr Pro Asp
 275 280 285
 Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu
 290 295 300
 Thr Leu Pro Ser Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala
 305 310 315 320
 Glu Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu
 325 330 335
 Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu
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 Glu Ile Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu
 355 360 365
 Val Lys Glu Glu Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln
 370 375 380
 Ala Lys Ala Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu
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 405 410 415
 Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln
 420 425 430
 Pro Ala Pro Ala Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys
 435 440 445
 Pro Ala Glu Gln Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu
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<210> 5

<211> 444

<212> PRT

<213> Streptococcus pneumoniae

<400> 5

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Thr	Glu	His	Arg	Lys	Ala	Ala	Lys	Gln	Val	Val	Asp	Glu	Tyr	Ile	Glu
			20					25					30		
Lys	Met	Leu	Glu	Arg	Ile	Gln	Leu	Asp	Arg	Arg	Lys	His	Thr	Gln	Asn
		35					40					45			
Val	Ala	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Arg
	50					55					60				
Glu	Leu	Asn	Val	Leu	Glu	Glu	Lys	Ser	Lys	Asp	Glu	Leu	Pro	Ser	Glu
65					70					75					80
Ile	Lys	Ala	Lys	Leu	Asp	Ala	Ala	Phe	Glu	Lys	Phe	Lys	Lys	Asp	Thr
				85					90					95	
Leu	Lys	Pro	Gly	Glu	Lys	Val	Ala	Glu	Ala	Lys	Lys	Val	Glu	Glu	Ala
			100					105					110		
Lys	Lys	Lys	Ala	Glu	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro
		115					120					125			
Thr	Asn	Thr	Tyr	Lys	Thr	Glu	Leu	Glu	Ile	Ala	Glu	Phe	Asp	Val	Lys
	130					135						140			
Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Ser
145					150					155					160
Arg	Asn	Glu	Gly	Thr	Ile	Lys	Gln	Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys
				165					170					175	
Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys
			180					185					190		
Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala
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Asn	Val	Ala	Thr	Ser	Asp	Gln	Gly	Lys	Pro	Lys	Gly	Arg	Ala	Lys	Arg
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Gly	Val	Pro	Gly	Glu	Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala
225					230					235					240
Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Ser	Ser
				245					250					255	
Leu	Lys	Leu	Ser	Gly	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu
			260					265					270		
Glu	Ala	Glu	Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn
		275					280					285			
Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Asp	Leu	Glu	Ile	Ala	Glu	Ser
	290					295					300				
Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala
305					310					315					320

Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys Val
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 Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp
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 Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Thr
 370 375 380
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<210> 6
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 <212> PRT
 <213> Streptococcus pneumoniae

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 Ser Ser Asn Met Ala Lys Thr Glu His Arg Lys Ala Ala Lys Gln Val
 50 55 60
 Val Asp Glu Tyr Ile Glu Lys Met Leu Arg Glu Ile Gln Leu Asp Arg
 65 70 75 80
 Arg Lys His Thr Gln Asn Val Ala Leu Asn Ile Lys Leu Ser Ala Ile
 85 90 95
 Lys Thr Lys Tyr Leu Arg Glu Leu Asn Val Leu Glu Glu Lys Ser Lys
 100 105 110
 Asp Glu Leu Pro Ser Glu Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu
 115 120 125
 Lys Phe Lys Lys Asp Thr Leu Lys Pro Gly Glu Lys Val Ala Glu Ala
 130 135 140
 Lys Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu
 145 150 155 160

Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	165	170	175
Glu	Ile	Ala	Glu	Phe	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	180	185	190
Val	Lys	Glu	Glu	Ala	Lys	Glu	Ser	Arg	Asn	Glu	Gly	Thr	Ile	Lys	Gln	195	200	205
Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	210	215	220
Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	225	230	235
Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala	Asn	Val	Ala	Thr	Ser	Asp	Gln	Gly	245	250	255
Lys	Pro	Lys	Gly	Arg	Ala	Lys	Arg	Gly	Val	Pro	Gly	Glu	Leu	Ala	Thr	260	265	270
Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly	275	280	285
Glu	Glu	Thr	Leu	Pro	Ser	Ser	Ser	Leu	Lys	Ser	Gly	Lys	Lys	Val	Glu	290	295	300
Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Glu	Lys	Lys	Ala	Lys	Asp	Gln	Lys	305	310	315
Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Asp	325	330	335
Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	340	345	350
Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Pro	Arg	Asp	Glu	Glu	Lys	Ile	Lys	355	360	365
Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	370	375	380
Glu	Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	385	390	395
Lys	Ala	Ala	Glu	Glu	Asp	Lys	Val	Lys	Glu	Lys	Pro	Ala	Glu	Gln	Pro	405	410	415
Gln	Pro	Ala	Pro	Ala	Thr	Gln	Pro	Glu	Lys	Pro	Ala	Pro	Lys	Pro	Glu	420	425	430
Lys	Pro	Ala	Glu	Gln	Pro	Lys	Ala	Glu	Lys	Thr	Asp	Asp	Gln	Gln	Ala	435	440	445
Glu	Glu	Asp	Tyr	Ala	Arg	Ser	Glu	Glu	Glu	Tyr	Asn	Arg	Leu	Thr	Gln	450	455	460
Gln	Gln	Pro	Pro	Lys	Thr	Glu	Lys	Pro	Ala	Gln	Pro	Ser	Thr	Pro	Lys	465	470	475
																		480

Thr

<210> 7

<211> 307

<212> PRT

<213> Streptococcus pneumoniae

<400> 7

Met Phe Ala Ser Lys Ser Glu Arg Lys Val His Tyr Ser Ile Arg Lys
1 5 10 15

Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala Ser Leu Phe Leu Gly
20 25 30

Gly Val Val His Ala Glu Gly Val Arg Ser Glu Asn Thr Pro Lys Val
35 40 45

Thr Ser Ser Gly Glu Tyr Ile Glu Lys Met Leu Arg Glu Ile Gln Leu
50 55 60

Asp Arg Arg Lys His Thr Gln Asn Val Ala Leu Asn Ile Lys Ile Ser
65 70 75 80

Ala Ile Lys Thr Lys Tyr Leu Arg Glu Leu Asn Val Leu Glu Glu Lys
85 90 95

Ser Lys Asp Glu Leu Pro Ser Glu Ile Lys Ala Lys Leu Asp Ala Ala
100 105 110

Phe Glu Lys Phe Lys Lys Asp Thr Leu Lys Pro Gly Glu Lys Val Ala
115 120 125

Glu Ala Lys Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln
130 135 140

Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu
145 150 155 160

Glu Leu Glu Ile Ala Glu Phe Asp Val Lys Val Lys Glu Ala Glu Leu
165 170 175

Glu Leu Val Lys Glu Glu Ala Lys Glu Phe Arg Asn Glu Gly Thr Ile
180 185 190

Lys Gln Ala Lys Glu Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg
195 200 205

Leu Glu Asn Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys
210 215 220

Arg Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln
225 230 235 240

Pro Gln Pro Ala Pro Ala Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro
245 250 255

Glu Lys Pro Ala Glu Gln Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln
260 265 270

Ala Glu Glu Asp Tyr Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu
275 280 285

Thr Gln Gln Gln Pro Pro Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr
290 295 300

Pro Lys Thr
305

<210> 8

<211> 434

<212> PRT

<213> Streptococcus pneumoniae

<400> 8

Met Phe Ala Ser Lys Ser Glu Arg Lys Val His Tyr Ser Ile Arg Lys
1 5 10 15

Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala Ser Leu Phe Leu Gly
20 25 30

Gly Val Val His Ala Glu Gly Val Arg Ser Glu Asn Thr Pro Lys Val
35 40 45

Thr Ser Ser Gly Asp Glu Val Asp Glu Tyr Ile Lys Lys Met Leu Ser
50 55 60

Glu Ile Gln Leu Asp Lys Arg Lys His Thr His Asn Phe Ala Leu Asn
65 70 75 80

Leu Lys Leu Ser Arg Ile Lys Thr Glu Tyr Leu Tyr Lys Leu Lys Val
85 90 95

Asn Val Leu Glu Glu Lys Ser Lys Ala Glu Leu Thr Ser Lys Thr Lys
100 105 110

Lys Glu Val Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr Leu Lys
115 120 125

Leu Gly Glu Lys Val Ala Glu Ala Gln Lys Lys Val Glu Glu Ala Lys
130 135 140

Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp His Arg Asn Tyr Pro Thr
145 150 155 160

Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Lys
165 170 175

Leu Lys Glu Ala Glu Leu Glu Leu Lys Glu Glu Ala Lys Thr Arg
180 185 190

Asn Glu Asp Thr Ile Asn Gln Ala Lys Ala Lys Val Lys Ser Glu Gln
195 200 205

Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu Gln Ala
210 215 220

Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Glu Lys Ala Glu

225 230 235 240
 Glu Ala Lys Arg Lys Ala Glu Ala Glu Glu Val Lys Asp Lys Leu Lys
 245 250 255
 Arg Arg Thr Lys Arg Ala Val Pro Gly Glu Pro Ala Thr Pro Asp Lys
 260 265 270
 Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr
 275 280 285
 Leu Pro Ser Pro Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Gln
 290 295 300
 Lys Lys Val Ala Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu
 305 310 315 320
 Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu
 325 330 335
 Ile Ala Glu Ser Asp Val Lys Val Lys Glu Lys Pro Ala Glu Gln Pro
 340 345 350
 Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu
 355 360 365
 Asn Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Pro Lys Pro Glu
 370 375 380
 Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro Ala Asp Gln Gln Ala
 385 390 395 400
 Glu Glu Asp Tyr Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr
 405 410 415
 Gln Gln Gln Pro Pro Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro
 420 425 430

Lys Thr

<210> 9

<211> 487

<212> PRT

<213> Streptococcus pneumoniae

<400> 9

Met Phe Ala Ser Lys Asn Glu Arg Lys Val His Tyr Ser Ile Arg Lys
 1 5 10 15

Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala Ser Leu Phe Met Gly
 20 25 30

Ser Val Val His Ala Thr Glu Lys Glu Val Thr Thr Gln Val Ala Thr
 35 40 45

Ser Phe Asn Lys Ala Asn Lys Ser Gln Thr Glu His Met Lys Ala Ala
 50 55 60

Lys Gln Val Asp Glu Tyr Ile Thr Lys Lys Leu Gln Leu Asp Arg Arg

65					70					75					80
Lys	His	Thr	Gln	Asn	Val	Gly	Leu	Leu	Thr	Lys	Leu	Gly	Val	Ile	Lys
				85					90					95	
Thr	Glu	Tyr	Leu	His	Arg	Leu	Ser	Val	Ser	Lys	Glu	Lys	Ser	Glu	Ala
			100					105					110		
Glu	Leu	Pro	Ser	Glu	Ile	Lys	Ala	Lys	Leu	Asp	Ala	Ala	Phe	Glu	Gln
		115					120					125			
Phe	Lys	Lys	Asp	Thr	Leu	Pro	Thr	Glu	Pro	Gly	Lys	Lys	Val	Ala	Glu
	130					135					140				
Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu	Asp	Gln	Lys
145					150					155					160
Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys	Thr	Leu	Glu
				165					170					175	
Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala	Glu	Leu	Glu
			180					185					190		
Leu	Val	Lys	Glu	Glu	Ala	Lys	Gly	Ser	Arg	Asn	Glu	Gln	Lys	Val	Asn
		195					200					205			
Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Lys	Gln	Ala	Glu	Ala	Thr	Arg	Leu
	210					215					220				
Lys	Lys	Ile	Lys	Thr	Asp	Arg	Glu	Gln	Ala	Glu	Thr	Thr	Arg	Leu	Glu
225					230					235					240
Asn	Ile	Lys	Thr	Asp	Arg	Glu	Lys	Ala	Glu	Glu	Ala	Lys	Arg	Lys	Ala
				245					250					255	
Asp	Ala	Lys	Glu	Gln	Asp	Glu	Ser	Lys	Arg	Arg	Val	Lys	Gly	Gly	Val
			260					265					270		
Pro	Gly	Glu	Gln	Ala	Thr	Leu	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser
		275					280					285			
Ser	Asp	Ser	Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Lys
	290					295					300				
Ser	Gly	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Ala	Glu	Ala	Glu
305					310					315					320
Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr
				325					330					335	
Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Lys
			340					345					350		
Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Ser
		355					360					365			
Arg	Asn	Glu	Glu	Lys	Val	Lys	Gln	Ala	Lys	Ala	Glu	Val	Glu	Ser	Lys
	370					375					380				
Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	Lys	Ile	Lys	Thr	Asp	Arg	Lys	Lys
385					390					395					400

Ala Glu Glu Ala Lys Arg Lys Ala Ala Glu Ser Glu Lys Val Lys Glu
405 410 415

Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys
420 425 430

Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala
435 440 445

Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu Asp Tyr Ala Arg Arg Ser
450 455 460

Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro Lys Thr Glu
465 470 475 480

Lys Pro Ala Gln Pro Ser Thr
485

<210> 10
<211> 483
<212> PRT
<213> Streptococcus pneumoniae

<400> 10
Met Phe Ala Ser Lys Ser Glu Arg Lys Val His Tyr Ser Ile Arg Lys
1 5 10 15

Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala Ser Leu Val Met Gly
20 25 30

Ser Val Val His Ala Thr Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr
35 40 45

Ser Ser Asn Met Ala Lys Thr Glu His Arg Lys Ala Ala Lys Gln Val
50 55 60

Val Asp Glu Tyr Ile Glu Lys Met Leu Arg Glu Ile Gln Leu Asp Arg
65 70 75 80

Arg Lys His Thr Gln Asn Val Ala Leu Asn Ile Lys Leu Ser Ala Ile
85 90 95

Lys Thr Lys Tyr Leu Arg Glu Leu Asn Val Leu Glu Glu Lys Ser Lys
100 105 110

Asp Glu Leu Pro Ser Glu Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu
115 120 125

Lys Phe Lys Lys Asp Thr Leu Lys Pro Gly Glu Lys Val Ala Glu Ala
130 135 140

Lys Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu
145 150 155 160

Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu
165 170 175

Glu Ile Ala Glu Phe Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu
180 185 190

Val	Lys	Glu	Glu	Ala	Lys	Glu	Ser	Arg	Asn	Glu	Gly	Thr	Ile	Lys	Gln	195	200	205
Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	210	215	220
Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	225	230	235
Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala	Asn	Val	Ala	Thr	Ser	Asp	Gln	Gly	245	250	255
Lys	Pro	Lys	Gly	Arg	Ala	Lys	Arg	Gly	Val	Pro	Gly	Glu	Leu	Ala	Thr	260	265	270
Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly	275	280	285
Glu	Glu	Thr	Leu	Pro	Ser	Ser	Ser	Leu	Lys	Ser	Gly	Lys	Lys	Val	Ala	290	295	300
Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Glu	Lys	Lys	Ala	Lys	Asp	Gln	305	310	315
Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	325	330	335
Asp	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	340	345	350
Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Pro	Arg	Asp	Glu	Glu	Lys	Thr	355	360	365
Lys	Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	370	375	380
Leu	Glu	Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	385	390	395
Arg	Lys	Ala	Ala	Glu	Glu	Asp	Lys	Val	Lys	Glu	Lys	Pro	Ala	Glu	Gln	405	410	415
Pro	Gln	Pro	Ala	Pro	Ala	Thr	Gln	Pro	Glu	Lys	Pro	Ala	Pro	Lys	Pro	420	425	430
Glu	Lys	Pro	Ala	Glu	Gln	Pro	Lys	Ala	Glu	Lys	Thr	Asp	Asp	Gln	Gln	435	440	445
Ala	Glu	Glu	Asp	Tyr	Ala	Arg	Arg	Ser	Glu	Glu	Glu	Tyr	Asn	Arg	Leu	450	455	460
Ile	Gln	Gln	Gln	Pro	Pro	Lys	Thr	Glu	Lys	Pro	Ala	Gln	Pro	Phe	Thr	465	470	475
Pro	Lys	Thr																

<210> 11
 <211> 329

<212> PRT

<213> Streptococcus pneumoniae

<400> 11

Met	Phe	Ala	Ser	Lys	Ser	Glu	Arg	Lys	Val	His	Tyr	Ser	Ile	Arg	Lys	
1				5					10					15		
Phe	Ser	Val	Gly	Val	Ala	Ser	Val	Val	Val	Ala	Ser	Leu	Val	Met	Gly	
			20					25					30			
Ser	Val	Val	His	Ala	Thr	Glu	Asn	Glu	Gly	Ala	Thr	Gln	Val	Pro	Thr	
			35				40					45				
Ser	Ser	Asn	Arg	Ala	Asn	Glu	Ser	Gln	Ala	Glu	Gln	Gly	Glu	Gln	Pro	
	50					55					60					
Lys	Lys	Leu	Asp	Ser	Glu	Arg	Asp	Lys	Ala	Lys	Thr	Ala	Val	Ser	Glu	
65					70					75					80	
Tyr	Lys	Glu	Lys	Lys	Val	Ser	Glu	Ile	Tyr	Thr	Lys	Leu	Glu	Arg	Asp	
				85					90					95		
Arg	His	Lys	Asp	Thr	Val	Asp	Leu	Val	Asn	Lys	Leu	Gln	Glu	Ile	Lys	
			100					105					110			
Asn	Glu	Tyr	Leu	Asn	Lys	Ile	Val	Gln	Ser	Thr	Ser	Lys	Thr	Glu	Ile	
		115					120					125				
Gln	Gly	Leu	Ile	Thr	Thr	Ser	Arg	Ser	Lys	Leu	Asp	Glu	Ala	Val	Ser	
	130					135					140					
Lys	Tyr	Lys	Lys	Ala	Pro	Ser	Ser	Ser	Ser	Ser	Ser	Gly	Ser	Ser	Thr	
145					150					155					160	
Lys	Pro	Glu	Ala	Ser	Asp	Thr	Ala	Lys	Pro	Asn	Lys	Pro	Thr	Glu	Leu	
				165					170					175		
Glu	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	
			180					185					190			
Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Tyr	Arg	Asn	Tyr	Pro	Thr	Ile	
		195					200					205				
Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	
	210					215					220					
Lys	Lys	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Pro	Arg	
225					230					235					240	
Asn	Glu	Glu	Lys	Val	Lys	Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Glu	Glu	
				245					250					255		
Thr	Glu	Ala	Thr	Arg	Leu	Glu	Lys	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	
			260					265					270			
Glu	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Ala	Glu	Glu	Asp	Lys	Val	Lys	Glu	
		275					280					285				
Lys	Pro	Ala	Glu	Gln	Gln	Ala	Glu	Glu	Asp	Tyr	Ala	Arg	Arg	Ser	Glu	
	290					295					300					

Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro Lys Thr Glu Lys
 305 310 315 320

Pro Ala Gln Pro Ser Thr Pro Lys Thr
 325

<210> 12

<211> 515

<212> PRT

<213> Streptococcus pneumoniae

<400> 12

Met Phe Ala Ser Lys Ser Glu Arg Lys Val His Tyr Ser Ile Arg Lys
 1 5 10 15

Phe Ser Val Gly Val Ala Ser Val Val Val Ala Ser Leu Val Met Gly
 20 25 30

Ser Val Val His Ala Thr Glu Asn Glu Gly Ala Thr Gln Val Pro Thr
 35 40 45

Ser Ser Asn Arg Ala Asn Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro
 50 55 60

Lys Lys Leu Asp Ser Glu Arg Asp Lys Ala Arg Lys Glu Val Glu Glu
 65 70 75 80

Tyr Val Lys Lys Ile Val Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys
 85 90 95

Arg His Thr Ile Thr Val Ala Leu Val Asn Glu Leu Asn Asn Ile Lys
 100 105 110

Asn Glu Tyr Leu Asn Lys Ile Val Glu Ser Thr Ser Glu Ser Gln Leu
 115 120 125

Gln Ile Leu Met Met Glu Ser Arg Ser Lys Val Asp Glu Ala Val Ser
 130 135 140

Lys Phe Glu Lys Asp Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr
 145 150 155 160

Lys Pro Glu Ala Ser Asp Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro
 165 170 175

Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu Ala Glu Lys
 180 185 190

Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile
 195 200 205

Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val
 210 215 220

Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala Asn Glu Pro Arg
 225 230 235 240

Asp Glu Gln Lys Ile Lys Gln Ala Glu Ala Glu Val Glu Ser Lys Gln
 245 250 255

Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala
 260 265 270
 Glu Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro
 275 280 285
 Lys Gly Arg Ala Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp
 290 295 300
 Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu
 305 310 315 320
 Thr Leu Pro Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala
 325 330 335
 Glu Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu
 340 345 350
 Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu
 355 360 365
 Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu
 370 375 380
 Val Lys Glu Glu Ala Lys Glu Pro Arg Asn Glu Glu Lys Val Lys Gln
 385 390 395 400
 Ala Lys Ala Glu Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu
 405 410 415
 Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys
 420 425 430
 Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln
 435 440 445
 Pro Ala Pro Ala Pro Lys Ala Glu Lys Pro Ala Pro Ala Pro Lys Pro
 450 455 460
 Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro Ala Asp Gln Gln
 465 470 475 480
 Ala Glu Glu Glu Tyr Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu
 485 490 495
 Thr Leu Gln Gln Pro Pro Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr
 500 505 510
 Pro Lys Thr
 515

<210> 13
 <211> 513
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 13
 Met Phe Ala Ser Lys Ser Glu Arg Lys Val His Tyr Ser Ile Arg Lys
 1 5 10 15

Phe Ser Val Gly Val Ala Ser Val Val Val Ala Ser Leu Val Met Gly
20 25 30
Ser Val Val His Ala Thr Glu Asn Glu Gly Ala Thr Gln Val Pro Thr
35 40 45
Ser Ser Asn Arg Ala Asn Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro
50 55 60
Lys Lys Leu Asp Ser Glu Arg Asp Lys Ala Arg Lys Glu Val Glu Glu
65 70 75 80
Tyr Val Lys Lys Ile Val Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys
85 90 95
Arg His Thr Ile Thr Val Ala Leu Val Asn Glu Leu Asn Asn Ile Lys
100 105 110
Asn Glu Tyr Leu Asn Lys Ile Val Glu Ser Thr Ser Glu Ser Gln Leu
115 120 125
Gln Ile Leu Met Met Glu Ser Arg Ser Lys Val Asp Glu Ala Val Ser
130 135 140
Lys Phe Glu Lys Asp Ser Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr
145 150 155 160
Lys Pro Glu Ala Ser Asp Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro
165 170 175
Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu Ala Glu Lys
180 185 190
Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile
195 200 205
Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val
210 215 220
Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala Asn Glu Pro Arg
225 230 235 240
Asp Glu Gln Lys Ile Lys Gln Ala Glu Ala Glu Val Glu Ser Lys Gln
245 250 255
Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala
260 265 270
Glu Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro
275 280 285
Lys Gly Arg Ala Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp
290 295 300
Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu
305 310 315 320
Thr Leu Pro Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala
325 330 335
Glu Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu

340										345				350			
Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu		
		355					360					365					
Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala	Glu	Leu	Glu	Leu		
	370					375					380						
Val	Lys	Glu	Glu	Ala	Lys	Glu	Pro	Arg	Asn	Glu	Glu	Lys	Val	Lys	Gln		
385					390					395					400		
Ala	Lys	Ala	Glu	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu		
				405					410					415			
Lys	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys		
			420					425					430				
Ala	Ala	Glu	Glu	Asp	Lys	Val	Lys	Glu	Lys	Pro	Ala	Glu	Gln	Pro	Gln		
		435					440					445					
Pro	Ala	Pro	Ala	Pro	Lys	Ala	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Lys	Pro		
	450					455					460						
Glu	Asn	Pro	Ala	Glu	Gln	Pro	Lys	Ala	Glu	Lys	Pro	Ala	Asp	Gln	Gln		
465					470					475					480		
Ala	Glu	Glu	Asp	Tyr	Ala	Arg	Arg	Ser	Glu	Glu	Glu	Tyr	Asn	Arg	Leu		
				485					490					495			
Thr	Gln	Gln	Gln	Pro	Pro	Lys	Thr	Glu	Lys	Pro	Ala	Gln	Pro	Ser	Thr		
			500					505					510				

Pro

<210> 14
 <211> 589
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 14

Glu	Gly	Val	Arg	Ser	Gly	Asn	Asn	Leu	Thr	Val	Thr	Ser	Ser	Gly	Gln
1				5					10					15	
Asp	Ile	Ser	Lys	Lys	Tyr	Ala	Asp	Glu	Val	Glu	Ser	His	Leu	Glu	Ser
			20					25					30		
Ile	Leu	Lys	Asp	Val	Lys	Lys	Asn	Leu	Lys	Lys	Val	Gln	His	Thr	Gln
	35						40					45			
Asn	Val	Gly	Leu	Ile	Thr	Lys	Leu	Ser	Glu	Ile	Lys	Lys	Lys	Tyr	Leu
	50					55					60				
Tyr	Asp	Leu	Lys	Val	Asn	Val	Leu	Ser	Glu	Ala	Glu	Leu	Thr	Ser	Lys
65					70					75					80
Thr	Lys	Glu	Thr	Lys	Glu	Lys	Leu	Thr	Ala	Thr	Phe	Glu	Gln	Phe	Lys
				85					90					95	
Lys	Asp	Thr	Leu	Pro	Thr	Glu	Pro	Glu	Lys	Lys	Val	Ala	Glu	Ala	Gln

100						105						110					
Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu	Asp	Gln	Lys	Glu	Lys		
		115						120						125			
Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu		
	130						135				140						
Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala	Glu	Leu	Glu	Leu	Val		
145					150					155					160		
Lys	Val	Lys	Ala	Lys	Glu	Ser	Gln	Asp	Glu	Glu	Lys	Ile	Lys	Gln	Ala		
				165					170					175			
Glu	Ala	Glu	Val	Glu	Ser	Lys	Gln	Ala	Glu	Ala	Thr	Arg	Leu	Lys	Lys		
			180					185					190				
Ile	Lys	Thr	Asp	Arg	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Asp	Ala	Lys	Leu		
		195					200						205				
Lys	Glu	Ala	Val	Glu	Lys	Asn	Val	Ala	Thr	Ser	Glu	Gln	Asp	Lys	Pro		
	210						215				220						
Lys	Arg	Arg	Ala	Lys	Arg	Gly	Val	Ser	Gly	Glu	Leu	Ala	Thr	Pro	Asp		
225					230					235					240		
Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly	Glu	Glu		
				245					250					255			
Thr	Leu	Pro	Ser	Pro	Ser	Leu	Asn	Met	Ala	Asn	Glu	Ser	Gln	Thr	Glu		
			260					265					270				
His	Arg	Lys	Asp	Val	Asp	Glu	Tyr	Ile	Lys	Lys	Met	Leu	Ser	Glu	Ile		
		275					280						285				
Gln	Leu	Asp	Arg	Arg	Lys	His	Thr	Gln	Asn	Val	Asn	Leu	Asn	Ile	Lys		
	290						295				300						
Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu	Leu	Ser	Val	Leu	Lys		
305					310					315					320		
Glu	Asn	Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys	Thr	Lys	Ala	Glu	Leu		
				325					330					335			
Thr	Ala	Ala	Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	Leu	Lys	Pro	Glu	Lys		
			340					345					350				
Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala		
		355						360					365				
Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr		
	370						375				380						
Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Lys	Val	Lys	Glu		
385					390					395					400		
Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Asn	Glu	Ser	Arg	Asn	Glu		
				405					410					415			
Glu	Lys	Ile	Lys	Gln	Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu		
			420					425					430				

Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu
435 440 445

Glu Ala Lys Arg Lys Ala Glu Glu Ser Glu Lys Lys Ala Ala Glu Ala
450 455 460

Lys Gln Lys Val Asp Ala Glu Glu Tyr Ala Leu Glu Ala Lys Ile Ala
465 470 475 480

Glu Leu Glu Tyr Glu Val Gln Arg Leu Glu Lys Glu Leu Lys Glu Ile
485 490 495

Asp Glu Ser Asp Ser Glu Asp Tyr Leu Lys Glu Gly Leu Arg Ala Pro
500 505 510

Leu Gln Ser Lys Leu Asp Thr Lys Lys Ala Lys Leu Ser Lys Leu Glu
515 520 525

Glu Leu Ser Asp Lys Ile Asp Glu Leu Asp Ala Glu Ile Ala Lys Leu
530 535 540

Glu Val Gln Leu Lys Asp Ala Glu Gly Asn Asn Asn Val Glu Ala Tyr
545 550 555 560

Phe Lys Glu Gly Leu Glu Lys Thr Thr Ala Glu Lys Lys Ala Glu Leu
565 570 575

Glu Lys Ala Glu Ala Asp Leu Lys Lys Ala Val Asp Glu
580 585

<210> 15
<211> 21
<212> PRT
<213> Streptococcus pneumoniae

<400> 15
Lys Thr Gly Trp Lys Gln Glu Asn Gly Asn Trp Tyr Phe Tyr Asn Thr
1 5 10 15

Asp Gly Ser Met Ala
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<210> 16
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 16
Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Met
1 5 10 15

Gly Ala Met Ala
20

<210> 17
<211> 20
<212> PRT

<213> Streptococcus pneumoniae

<400> 17

Thr	Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn
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Gly Ser Met Ala
20

<210> 18

<211> 20

<212> PRT

<213> Streptococcus pneumoniae

<400> 18

Thr	Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn
1				5					10					15	

Gly Ala Met Ala
20

<210> 19

<211> 20

<212> PRT

<213> Streptococcus pneumoniae

<400> 19

Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn
1				5					10					15	

Gly Asp Met Ala
20

<210> 20

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<212> PRT

<213> Streptococcus pneumoniae

<400> 20

Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ser	Asn
1				5					10					15	

Gly Ala Met Ala
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<212> PRT

<213> Streptococcus pneumoniae

<400> 21

Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn
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Gly Asp Met Ala
20

<210> 22
<211> 20
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<213> Streptococcus pneumoniae

<400> 22
Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
1 5 10 15
Gly Asp Met Ala
20

<210> 23
<211> 19
<212> PRT
<213> Streptococcus pneumoniae

<400> 23
Thr Gly Trp Leu Gln Tyr Asn Ser Trp Tyr Tyr Leu Asn Ala Asn Gly
1 5 10 15
Asp Met Ala

<210> 24
<211> 21
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<400> 24
Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser
1 5 10 15
Gly Ala Met Lys Ala
20

<210> 25
<211> 20
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<213> Streptococcus pneumoniae

<400> 25
Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Ser
1 5 10 15
Gly Ala Leu Ala
20

<210> 26
<211> 18
<212> PRT
<213> Streptococcus pneumoniae

<400> 26
Val Asn Thr Thr Val Asp Gly Tyr Gly Val Asn Ala Asn Gly Glu Trp
1 5 10 15

Val Asn

<210> 27

<211> 20

<212> PRT

<213> Streptococcus pneumoniae

<400> 27

Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
1 5 10 15

Gly Ala Met Ala
20

<210> 28

<211> 20

<212> PRT

<213> Streptococcus pneumoniae

<220>

<221> UNSURE

<222> (1)..(20)

<223> amino acid "X" can be any amino acid

<400> 28

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Gly Ala Met Ala
20

<210> 29

<211> 17

<212> PRT

<213> Streptococcus pneumoniae

<400> 29

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1 5 10 15

Val

<210> 30

<211> 20

<212> PRT

<213> Streptococcus pneumoniae

<400> 30

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1 5 10 15

Gly Ser Met Ala
20

<210> 31
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Gly Ala Met Ala
20

<210> 32
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<212> PRT
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<400> 32
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1 5 10 15

Gly Ala Met Ala
20

<210> 33
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 33
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1 5 10 15

Gly Ala Met Ala
20

<210> 34
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 34
Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
1 5 10 15

Gly Asp Met Ala
20

<210> 35
<211> 20
<212> PRT
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<400> 35
Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
1 5 10 15

Gly Asp Met Ala
20

<210> 36
<211> 20
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<213> Streptococcus pneumoniae

<400> 36
Thr Gly Trp Ala Lys Val His Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
1 5 10 15

Gly Ser Met Ala
20

<210> 37
<211> 21
<212> PRT
<213> Streptococcus pneumoniae

<400> 37
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1 5 10 15

Gly Ser Met Lys Ala
20

<210> 38
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 38
Asn Gln Trp Phe Gln Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Leu
1 5 10 15

Gly Ser Leu Ser
20

<210> 39
<211> 17
<212> PRT
<213> Streptococcus pneumoniae

<400> 39
Val Asn Thr Thr Val Asp Gly Tyr Lys Val Asn Ala Asn Gly Glu Trp
1 5 10 15

Val

<210> 40
<211> 20
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<213> Streptococcus pneumoniae

<400> 40
Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
1 5 10 15

Gly Ser Met Ala
20

<210> 41
<211> 21
<212> PRT
<213> Streptococcus pneumoniae

<400> 41
Lys Thr Gly Trp Lys Gln Glu Asn Gly Asn Trp Tyr Phe Tyr Asn Thr
1 5 10 15

Asp Gly Ser Met Ala
20

<210> 42
<211> 20
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<400> 42
Thr Gly Trp Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp
1 5 10 15

Gly Ser Met Ala
20

<210> 43
<211> 20
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<213> Streptococcus pneumoniae

<400> 43
Ile Gly Trp Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp
1 5 10 15

Gly Ser Met Ala
20

<210> 44
<211> 21
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<400> 44
Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser
1 5 10 15

Gly Ala Met Lys Ala
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<210> 45
<211> 21
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<213> Streptococcus pneumoniae

<400> 45
Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser
1 5 10 15
Gly Ala Met Lys Ala
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<210> 46
<211> 21
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<213> Streptococcus pneumoniae

<400> 46
Thr Gly Trp Val Lys Asp Gly Glu Thr Trp Tyr Tyr Leu Glu Ala Ser
1 5 10 15
Gly Ser Met Lys Ala
20

<210> 47
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 47
Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Ser
1 5 10 15
Gly Ala Leu Ala
20

<210> 48
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 48
Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Leu
1 5 10 15
Gly Ala Leu Ala
20

<210> 49
<211> 20
<212> PRT
<213> Streptococcus pneumoniae

<400> 49
Asn Gln Trp Phe Gln Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Leu
1 5 10 15

Gly Ser Leu Ser
20

<210> 50
<211> 18
<212> PRT
<213> Streptococcus pneumoniae

<400> 50
Val Asn Thr Thr Val Asp Gly Tyr Gly Val Asn Ala Asn Gly Glu Trp
1 5 10 15

Val Asn

<210> 51
<211> 17
<212> PRT
<213> Streptococcus pneumoniae

<400> 51
Val Asn Thr Thr Val Asp Gly Tyr Lys Val Asn Ala Asn Gly Glu Trp
1 5 10 15

Val

<210> 52
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<212> PRT
<213> Streptococcus pneumoniae

<400> 52
Val Asn Thr Thr Val Asp Gly Tyr Lys Val Asn Ala Asn Gly Glu Trp
1 5 10 15

Val

<210> 53
<211> 1620
<212> DNA
<213> Streptococcus pneumoniae

<220>
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<222> (1)..(1617)
<223> coding sequence for SpsA

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ttt agt att gga gta gct agt gta gct gtt gcc agt ctt gtt atg gga 96
Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala Ser Leu Val Met Gly
20 25 30

agt gtg gtt cat gcg aca gag aac gag gga agt acc caa gca gcc act	144
Ser Val Val His Ala Thr Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr	
35 40 45	
tct tct aat atg gca aag aca gaa cat agg aaa gct gct aaa caa gtc	192
Ser Ser Asn Met Ala Lys Thr Glu His Arg Lys Ala Ala Lys Gln Val	
50 55 60	
gtc gat gaa tat ata gaa aaa atg ttg agg gag att caa cta gat aga	240
Val Asp Glu Tyr Ile Glu Lys Met Leu Arg Glu Ile Gln Leu Asp Arg	
65 70 75 80	
aga aaa cat acc caa aat gtc gcc tta aac ata aag ttg agc gca att	288
Arg Lys His Thr Gln Asn Val Ala Leu Asn Ile Lys Leu Ser Ala Ile	
85 90 95	
aaa acg aag tat ttg cgt gaa tta aat gtt tta gaa gag aag tcg aaa	336
Lys Thr Lys Tyr Leu Arg Glu Leu Asn Val Leu Glu Glu Lys Ser Lys	
100 105 110	
gat gag ttg ccg tca gaa ata aaa gca aag tta gac gca gct ttt gag	384
Asp Glu Leu Pro Ser Glu Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu	
115 120 125	
aag ttt aaa aaa gat aca ttg aaa cca gga gaa aag gta gca gaa gct	432
Lys Phe Lys Lys Asp Thr Leu Lys Pro Gly Glu Lys Val Ala Glu Ala	
130 135 140	
aag aag aag gtt gaa gaa gct aag aaa aaa gcc gag gat caa aaa gaa	480
Lys Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu	
145 150 155 160	
gaa gat cgt cgt aac tac cca acc aat act tac aaa acg ctt gaa ctt	528
Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu	
165 170 175	
gaa att gct gag ttc gat gtg aaa gtt aaa gaa gcg gag ctt gaa cta	576
Glu Ile Ala Glu Phe Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu	
180 185 190	
gta aaa gag gaa gct aaa gaa ttt cga aac gag ggc aca att aag caa	624
Val Lys Glu Glu Ala Lys Glu Phe Arg Asn Glu Gly Thr Ile Lys Gln	
195 200 205	
gca aaa gag aaa gtt gag agt aaa aaa gct gag gct aca agg tta gaa	672
Ala Lys Glu Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu	
210 215 220	
aac atc aag aca gat cgt aaa aaa gca gaa gaa gaa gct aaa cga aaa	720
Asn Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys	
225 230 235 240	
gca gca gaa gaa gat aaa gtt aaa gaa aaa cca gct gaa caa cca caa	768
Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln	
245 250 255	
cca gcg ccg gct act caa cca gaa aaa cca gct cca aaa cca gag aag	816
Pro Ala Pro Ala Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys	
260 265 270	

cca gct gaa caa cca aaa gca gaa aaa aca gat gat caa caa gct gaa	864
Pro Ala Glu Gln Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu	
275 280 285	
gaa gac tat gct cgt aga tca gaa gaa gaa tat aat cgc ttg act caa	912
Glu Asp Tyr Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln	
290 295 300	
cag caa ccg cca aaa act gaa aaa cca gca caa cca tct act cca aaa	960
Gln Gln Pro Pro Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys	
305 310 315 320	
aca ggc tgg aaa caa gaa aac ggt atg tgg tac ttc tac aat act gat	1008
Thr Gly Trp Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp	
325 330 335	
ggt tca atg gca aca gga tgg ctc caa aac aac ggt tca tgg tac tat	1056
Gly Ser Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr	
340 345 350	
cta aac gct aat ggt gct atg gcg aca gga tgg ctc caa aac aat ggt	1104
Leu Asn Ala Asn Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly	
355 360 365	
tca tgg tac tat cta aac gct aat ggt tca atg gca aca gga tgg ctc	1152
Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ser Met Ala Thr Gly Trp Leu	
370 375 380	
caa aac aat ggt tca tgg tac tac cta aac gct aat ggt gct atg gcg	1200
Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ala Met Ala	
385 390 395 400	
aca gga tgg ctc caa tac aat ggt tca tgg tac tac cta aac agc aat	1248
Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ser Asn	
405 410 415	
ggc gct atg gcg aca gga tgg ctc caa tac aat ggc tca tgg tac tac	1296
Gly Ala Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr	
420 425 430	
ctc aac gct aat ggt gat atg gcg aca gga tgg ctc caa aac aac ggt	1344
Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu Gln Asn Asn Gly	
435 440 445	
tca tgg tac tac ctc aac gct aat ggt gat atg gcg aca gga tgg ctc	1392
Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu	
450 455 460	
caa tac aac ggt tca tgg tat tac ctc aac gct aat ggt gat atg gcg	1440
Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala	
465 470 475 480	
aca ggt tgg gtg aaa gat gga gat acc tgg tac tat ctt gaa aca tca	1488
Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Thr Ser	
485 490 495	
ggt gct atg aaa gca agc caa tgg ttc aaa gta tca gat aaa tgg tac	1536
Gly Ala Met Lys Ala Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr	
500 505 510	
tat gtc cat ggc tca agt gcc ctt gca atc aac aca act gta tat ggc	1584

Tyr Val His Gly Ser Ser Ala Leu Ala Ile Asn Thr Thr Val Tyr Gly
515 520 525

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Tyr Gly Val Asn Ala Asn Gly Glu Trp Val Asn
530 535

<210> 54
<211> 539
<212> PRT
<213> Streptococcus pneumoniae

<400> 54
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Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala Ser Leu Val Met Gly
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Ser Val Val His Ala Thr Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr
35 40 45

Ser Ser Asn Met Ala Lys Thr Glu His Arg Lys Ala Ala Lys Gln Val
50 55 60

Val Asp Glu Tyr Ile Glu Lys Met Leu Arg Glu Ile Gln Leu Asp Arg
65 70 75 80

Arg Lys His Thr Gln Asn Val Ala Leu Asn Ile Lys Leu Ser Ala Ile
85 90 95

Lys Thr Lys Tyr Leu Arg Glu Leu Asn Val Leu Glu Glu Lys Ser Lys
100 105 110

Asp Glu Leu Pro Ser Glu Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu
115 120 125

Lys Phe Lys Lys Asp Thr Leu Lys Pro Gly Glu Lys Val Ala Glu Ala
130 135 140

Lys Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu
145 150 155 160

Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu
165 170 175

Glu Ile Ala Glu Phe Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu
180 185 190

Val Lys Glu Glu Ala Lys Glu Phe Arg Asn Glu Gly Thr Ile Lys Gln
195 200 205

Ala Lys Glu Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu
210 215 220

Asn Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys
225 230 235 240

Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln
245 250 255

Pro Ala Pro Ala Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys
 260 265 270
 Pro Ala Glu Gln Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu
 275 280 285
 Glu Asp Tyr Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln
 290 295 300
 Gln Gln Pro Pro Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys
 305 310 315 320
 Thr Gly Trp Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp
 325 330 335
 Gly Ser Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr
 340 345 350
 Leu Asn Ala Asn Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly
 355 360 365
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ser Met Ala Thr Gly Trp Leu
 370 375 380
 Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ala Met Ala
 385 390 395 400
 Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ser Asn
 405 410 415
 Gly Ala Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr
 420 425 430
 Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu Gln Asn Asn Gly
 435 440 445
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu
 450 455 460
 Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala
 465 470 475 480
 Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Thr Ser
 485 490 495
 Gly Ala Met Lys Ala Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr
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 515 520 525
 Tyr Gly Val Asn Ala Asn Gly Glu Trp Val Asn
 530 535

<210> 55
 <211> 1746
 <212> DNA
 <213> Streptococcus pneumoniae

<220>

<221> CDS

<222> (1)..(1743)

<223> additional coding sequence for SpsA

<400> 55

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Phe	Ser	Ile	Gly	Val	Ala	Ser	Val	Ala	Val	Ala	Ser	Leu	Val	Met	Gly	
			20					25					30			
agt	gtg	gtt	cat	gcg	aca	gag	aac	gag	gga	agt	acc	caa	gca	gcc	act	144
Ser	Val	Val	His	Ala	Thr	Glu	Asn	Glu	Gly	Ser	Thr	Gln	Ala	Ala	Thr	
			35				40					45				
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Ser	Ser	Asn	Met	Ala	Lys	Thr	Glu	His	Arg	Lys	Ala	Ala	Lys	Gln	Val	
	50					55					60					
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Val	Asp	Glu	Tyr	Ile	Glu	Lys	Met	Leu	Arg	Glu	Ile	Gln	Leu	Asp	Arg	
65					70				75						80	
aga	aaa	cat	acc	caa	aat	gtc	gcc	tta	aac	ata	aag	ttg	agc	gca	att	288
Arg	Lys	His	Thr	Gln	Asn	Val	Ala	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	
				85				90						95		
aaa	acg	aag	tat	ttg	cgt	gaa	tta	aat	gtt	tta	gaa	gag	aag	tcg	aaa	336
Lys	Thr	Lys	Tyr	Leu	Arg	Glu	Leu	Asn	Val	Leu	Glu	Glu	Lys	Ser	Lys	
			100					105					110			
gat	gag	ttg	ccg	tca	gaa	ata	aaa	gca	aag	tta	gac	gca	gct	ttt	gag	384
Asp	Glu	Leu	Pro	Ser	Glu	Ile	Lys	Ala	Lys	Leu	Asp	Ala	Ala	Phe	Glu	
		115					120					125				
aag	ttt	aaa	aaa	gat	aca	ttg	aaa	cca	gga	gaa	aag	gta	gca	gaa	gct	432
Lys	Phe	Lys	Lys	Asp	Thr	Leu	Lys	Pro	Gly	Glu	Lys	Val	Ala	Glu	Ala	
	130					135					140					
aag	aag	aag	gtt	gaa	gaa	gct	aag	aaa	aaa	gcc	gag	gat	caa	aaa	gaa	480
Lys	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu	Asp	Gln	Lys	Glu	
145					150					155					160	
gaa	gat	cgt	cgt	aac	tac	cca	acc	aat	act	tac	aaa	acg	ctt	gaa	ctt	528
Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	
				165				170						175		
gaa	att	gct	gag	ttc	gat	gtg	aaa	gtt	aaa	gaa	gcg	gag	ctt	gaa	cta	576
Glu	Ile	Ala	Glu	Phe	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	
			180				185						190			
gta	aaa	gag	gaa	gct	aaa	gaa	tct	cga	aac	gag	ggc	aca	att	aag	caa	624
Val	Lys	Glu	Glu	Ala	Lys	Glu	Ser	Arg	Asn	Glu	Gly	Thr	Ile	Lys	Gln	
		195				200						205				
gca	aaa	gag	aaa	gtt	gag	agt	aaa	aaa	gct	gag	gct	aca	agg	tta	gaa	672
Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	

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aac atc aag aca gat Asn Ile Lys Thr Asp 225	cgt aaa aaa gca gaa gaa gaa gct aaa cga aaa Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys 230 235 240	720	
gca gat gct aag ttg Ala Asp Ala Lys Leu 245	aag gaa gct aat gta gcg act tca gat caa ggt Lys Glu Ala Asn Val Ala Thr Ser Asp Gln Gly 250 255	768	
aaa cca aag ggg cgg Lys Pro Lys Gly Arg 260	gca aaa cga gga gtt cct gga gag cta gca aca Ala Lys Arg Gly Val Pro Gly Glu Leu Ala Thr 265 270	816	
cct gat aaa aaa gaa aat gat gcg aag tct tca gat tct agc gta ggt Pro Asp Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly 275 280 285	864		
gaa gaa act ctt cca agc tca tcc ctg aaa tca gga aaa aag gta gca Glu Glu Thr Leu Pro Ser Ser Ser Leu Lys Ser Gly Lys Lys Val Ala 290 295 300	912		
gaa gct gag aag aag gtt gaa gaa gct gag aaa aaa gcc aag gat caa Glu Ala Glu Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln 305 310 315 320	960		
aaa gaa gaa gat cgc cgt aat tac cca acc aat act tac aaa acg ctt Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu 325 330 335	1008		
gac ctt gaa att gct gag tcc gat gtg aaa gtt aaa gaa gcg gag ctt Asp Leu Glu Ile Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu 340 345 350	1056		
gaa cta gta aaa gag gaa gct aag gaa cct cga gac gag gaa aaa att Glu Leu Val Lys Glu Glu Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile 355 360 365	1104		
aag caa gca aaa gcg aaa gtt gag agt aaa aaa gct gag gct aca agg Lys Gln Ala Lys Ala Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg 370 375 380	1152		
tta gaa aac atc aag aca gat cgt aaa aaa gca gaa gaa gaa gct aaa Leu Glu Asn Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys 385 390 395 400	1200		
cga aaa gca gca gaa gaa gat aaa gtt aaa gaa aaa cca gct gaa caa Arg Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln 405 410 415	1248		
cca caa cca gcg ccg gct act caa cca gaa aaa cca gct cca aaa cca Pro Gln Pro Ala Pro Ala Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro 420 425 430	1296		
gag aag cca gct gaa caa cca aaa gca gaa aaa aca gat gat caa caa Glu Lys Pro Ala Glu Gln Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln 435 440 445	1344		
gct gaa gaa gac tat gct cgt aga tca gaa gaa gaa tat aat cgc ttg Ala Glu Glu Asp Tyr Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu 450 455 460	1392		

att caa cag caa ccg cca aaa act gaa aaa cca gca caa cca ttt act	1440
Ile Gln Gln Gln Pro Pro Lys Thr Glu Lys Pro Ala Gln Pro Phe Thr	
465 470 475 480	
cca aaa aca ggc tgg aaa caa gaa aac ggt atg tgg tac ttc tac aat	1488
Pro Lys Thr Gly Trp Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn	
485 490 495	
act gat ggt tca atg gca aca gga tgg ctc caa tac aac ggt tca tgg	1536
Thr Asp Gly Ser Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp	
500 505 510	
tat tac ctc aac gct aat ggt gat atg gcg aca ggt tgg gtg aaa gat	1584
Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Val Lys Asp	
515 520 525	
gga gat acc tgg tac tat ctt gaa gca tca ggt gct atg aaa gca agc	1632
Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser Gly Ala Met Lys Ala Ser	
530 535 540	
caa tgg ttc aaa gta tca gat aaa tgg tac tat gtc aat ggc tca ggt	1680
Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Ser Gly	
545 550 555 560	
gcc ctt gca gtc aac aca act gta gat ggc tat gga gtc aat gcc aat	1728
Ala Leu Ala Val Asn Thr Thr Val Asp Gly Tyr Gly Val Asn Ala Asn	
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Gly Glu Trp Val Asn	
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35 40 45	
Ser Ser Asn Met Ala Lys Thr Glu His Arg Lys Ala Ala Lys Gln Val	
50 55 60	
Val Asp Glu Tyr Ile Glu Lys Met Leu Arg Glu Ile Gln Leu Asp Arg	
65 70 75 80	
Arg Lys His Thr Gln Asn Val Ala Leu Asn Ile Lys Leu Ser Ala Ile	
85 90 95	
Lys Thr Lys Tyr Leu Arg Glu Leu Asn Val Leu Glu Glu Lys Ser Lys	
100 105 110	

Asp	Glu	Leu	Pro	Ser	Glu	Ile	Lys	Ala	Lys	Leu	Asp	Ala	Ala	Phe	Glu		
	115						120					125					
Lys	Phe	Lys	Lys	Asp	Thr	Leu	Lys	Pro	Gly	Glu	Lys	Val	Ala	Glu	Ala		
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Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu		
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Glu	Ile	Ala	Glu	Phe	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu		
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Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu		
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Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys		
225					230					235					240		
Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala	Asn	Val	Ala	Thr	Ser	Asp	Gln	Gly		
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Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly		
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Glu	Glu	Thr	Leu	Pro	Ser	Ser	Ser	Leu	Lys	Ser	Gly	Lys	Lys	Val	Ala		
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Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Glu	Lys	Lys	Ala	Lys	Asp	Gln		
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Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu		
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Asp	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu		
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Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Pro	Arg	Asp	Glu	Glu	Lys	Ile		
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Lys	Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg		
	370					375					380						
Leu	Glu	Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys		
385					390					395					400		
Arg	Lys	Ala	Ala	Glu	Glu	Asp	Lys	Val	Lys	Glu	Lys	Pro	Ala	Glu	Gln		
				405					410					415			
Pro	Gln	Pro	Ala	Pro	Ala	Thr	Gln	Pro	Glu	Lys	Pro	Ala	Pro	Lys	Pro		
			420					425					430				
Glu	Lys	Pro	Ala	Glu	Gln	Pro	Lys	Ala	Glu	Lys	Thr	Asp	Asp	Gln	Gln		

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Ala Glu Glu Asp Tyr	Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu	
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Ile Gln Gln Gln Pro	Pro Lys Thr Glu Lys Pro Ala Gln Pro Phe Thr	
465	470	475
Pro Lys Thr Gly Trp	Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn	
	485	490
Thr Asp Gly Ser Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp		
	500	505
Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Val Lys Asp		
	515	520
Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser Gly Ala Met Lys Ala Ser		
	530	535
Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Ser Gly		
	545	550
Ala Leu Ala Val Asn Thr Thr Val Asp Gly Tyr Gly Val Asn Ala Asn		
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Gly Glu Trp Val Asn		
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aca gaa cat agg aaa gct gct aaa caa gtc gtc gat gaa tat ata gaa	96
Thr Glu His Arg Lys Ala Ala Lys Gln Val Val Asp Glu Tyr Ile Glu	
20 25 30	
aaa atg ttg agg gag att caa cta gat aga aga aaa cat acc caa aat	144
Lys Met Leu Arg Glu Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn	
35 40 45	
gtc gcc tta aac ata aag ttg agc gca att aaa acg aag tat ttg cgt	192
Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg	
50 55 60	
gaa tta aat gtt tta gaa gag aag tcg aaa gat gag ttg ccg tca gaa	240
Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu	

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ata aaa gca aag tta gac gca gct ttt gag aag ttt aaa aaa gat aca				288
Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr	85	90	95	
ttg aaa cca gga gaa aag gta gca gaa gct aag aag aag gtt gaa gaa				336
Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu	100	105	110	
gct aag aaa aaa gcc gag gat caa aaa gaa gaa gat cgt cgt aac tac				384
Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr	115	120	125	
cca acc aat act tac aaa acg ctt gaa ctt gaa att gct gag ttc gat				432
Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp	130	135	140	
gtg aaa gtt aaa gaa gcg gag ctt gaa cta gta aaa gag gaa gct aaa				480
Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys	145	150	155	160
gaa tct cga aac gag ggc aca att aag caa gca aaa gag aaa gtt gag				528
Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu	165	170	175	
agt aaa aaa gct gag gct aca agg tta gaa aac atc aag aca gat cgt				576
Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg	180	185	190	
aaa aaa gca gaa gaa gaa gct aaa cga aaa gca gat gct aag ttg aag				624
Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys	195	200	205	
gaa gct aat gta gcg act tca gat caa ggt aaa cca aag ggg cgg gca				672
Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala	210	215	220	
aaa cga gga gtt cct gga gag cta gca aca cct gat aaa aaa gaa aat				720
Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn	225	230	235	240
gat gcg aag tct tca gat tct agc gta ggt gaa gaa act ctt cca agc				768
Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser	245	250	255	
tca tcc ctg aaa tca gga aaa aag gta gca gaa gct gag aag aag gtt				816
Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val	260	265	270	
gaa gaa gct gag aaa aaa gcc aag gat caa aaa gaa gaa gat cgc cgt				864
Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg	275	280	285	
aac tac cca acc aat act tac aaa acg ctt gac ctt gaa att gct gag				912
Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu	290	295	300	
tcc gat gtg aaa gtt aaa gaa gcg gag ctt gaa cta gta aaa gag gaa				960
Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu	305	310	315	320

gct aag gaa cct cga gac gag gaa aaa att aag caa gca aaa gcg aaa	1008
Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys	
325 330 335	
gtt gag agt aaa aaa gct gag gct aca agg tta gaa aac atc aag aca	1056
Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr	
340 345 350	
gat cgt aaa aaa gca gaa gaa gaa gct aaa cga aaa gca gca gaa gaa	1104
Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu	
355 360 365	
gat aaa gtt aaa gaa aaa cca gct gaa caa cca caa cca gcg ccg gct	1152
Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala	
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act caa cca gaa aaa cca gct cca aaa cca gag aag cca gct gaa caa	1200
Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln	
385 390 395 400	
cca aaa gca gaa aaa aca gat gat caa caa gct gaa gaa gac tat gct	1248
Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu Asp Tyr Ala	
405 410 415	
cgt aga tca gaa gaa gaa tat aat cgc ttg act caa cag caa ccg cca	1296
Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro	
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aaa act gaa aaa cca gca caa cca tct act cca aaa aca ggc tgg aaa	1344
Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys Thr Gly Trp Lys	
435 440 445	
caa gaa aac ggt atg tgg tac ttc tac aat act gat ggt tca atg gca	1392
Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp Gly Ser Met Ala	
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aca gga tgg ctc caa aac aac ggt tca tgg tac tat cta aac gct aat	1440
Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn	
465 470 475 480	
ggt gct atg gcg aca gga tgg ctc caa aac aat ggt tca tgg tac tat	1488
Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr	
485 490 495	
cta aac gct aat ggt tca atg gca aca gga tgg ctc caa aac aat ggt	1536
Leu Asn Ala Asn Gly Ser Met Ala Thr Gly Trp Leu Gln Asn Asn Gly	
500 505 510	
tca tgg tac tac cta aac gct aat ggt gct atg gcg aca gga tgg ctc	1584
Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ala Met Ala Thr Gly Trp Leu	
515 520 525	
caa tac aat ggt tca tgg tac tac cta aac agc aat ggc gct atg gcg	1632
Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ser Asn Gly Ala Met Ala	
530 535 540	
aca gga tgg ctc caa tac aat ggc tca tgg tac tac ctc aac gct aat	1680
Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn	
545 550 555 560	

ggt gat atg gcg aca gga tgg ctc caa aac aac ggt tca tgg tac tac 1728
 Gly Asp Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr
 565 570 575

ctc aac gct aat ggt gat atg gcg aca gga tgg ctc caa tac aac ggt 1776
 Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly
 580 585 590

tca tgg tat tac ctc aac gct aat ggt gat atg gcg aca ggt tgg gtg 1824
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Val
 595 600 605

aaa gat gga gat acc tgg tac tat ctt gaa gca tca ggt gct atg aaa 1872
 Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser Gly Ala Met Lys
 610 615 620

gca agc caa tgg ttc aaa gta tca gat aaa tgg tac tat gtc aat ggc 1920
 Ala Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly
 625 630 635 640

tca ggt gcc ctt gca gtc aac aca act gta gat ggc tat gga gtc aat 1968
 Ser Gly Ala Leu Ala Val Asn Thr Thr Val Asp Gly Tyr Gly Val Asn
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gcc aat ggt gaa tgg gta aac taa acctaataata actagttaata actgacttcc 2022
 Ala Asn Gly Glu Trp Val Asn
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tgtaagaact ttttaaagta ttccctacaa ataccatata ctttcagtag ataataatacc 2082
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 <212> PRT
 <213> Streptococcus pneumoniae

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 Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg
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 Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu

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Ala	Lys	Lys	Lys	Ala	Glu	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr
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Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Phe	Asp
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Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys
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Glu	Ser	Arg	Asn	Glu	Gly	Thr	Ile	Lys	Gln	Ala	Lys	Glu	Lys	Val	Glu
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Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	Asn	Ile	Lys	Thr	Asp	Arg
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Glu	Ala	Asn	Val	Ala	Thr	Ser	Asp	Gln	Gly	Lys	Pro	Lys	Gly	Arg	Ala
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Lys	Arg	Gly	Val	Pro	Gly	Glu	Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn
				230						235					240
Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser
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Ser	Ser	Leu	Lys	Ser	Gly	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val
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Glu	Glu	Ala	Glu	Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg
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Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Asp	Leu	Glu	Ile	Ala	Glu
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Ser	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu
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Ala	Lys	Glu	Pro	Arg	Asp	Glu	Glu	Lys	Ile	Lys	Gln	Ala	Lys	Ala	Lys
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Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	Asn	Ile	Lys	Thr
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Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Ala	Glu	Glu
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Asp	Lys	Val	Lys	Glu	Lys	Pro	Ala	Glu	Gln	Pro	Gln	Pro	Ala	Pro	Ala
			370			375					380				
Thr	Gln	Pro	Glu	Lys	Pro	Ala	Pro	Lys	Pro	Glu	Lys	Pro	Ala	Glu	Gln
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Pro	Lys	Ala	Glu	Lys	Thr	Asp	Asp	Gln	Gln	Ala	Glu	Glu	Asp	Tyr	Ala
				405					410					415	
Arg	Arg	Ser	Glu	Glu	Glu	Tyr	Asn	Arg	Leu	Thr	Gln	Gln	Gln	Pro	Pro
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Gly	Ala	Met	Ala	Thr	Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	Tyr	Tyr
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Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Ala	Met	Ala	Thr	Gly	Trp	Leu
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Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ser	Asn	Gly	Ala	Met	Ala
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Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn
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Gly	Asp	Met	Ala	Thr	Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	Tyr	Tyr		
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Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Asp	Met	Ala	Thr	Gly	Trp	Val		
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 atatagaagg aaataaac atg ttt gca tca aaa agc gaa aga aaa gta cat 351
 Met Phe Ala Ser Lys Ser Glu Arg Lys Val His
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 tat tca att cgt aaa ttt agt att gga gta gct agt gta gct gtt gcc 399
 Tyr Ser Ile Arg Lys Phe Ser Ile Gly Val Ala Ser Val Ala Val Ala
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 Ser Leu Phe Leu Gly Gly Val Val His Ala Glu Gly Val Arg Ser Gly
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 Asn Asn Leu Thr Val Thr Ser Ser Gly Gln Asp Ile Ser Lys Lys Tyr
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 gct gat gaa gtc gag tcg cat cta gaa agt ata ttg aag gat gtc aaa 543
 Ala Asp Glu Val Glu Ser His Leu Glu Ser Ile Leu Lys Asp Val Lys
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 aaa aat ttg aaa aaa gtt caa cat acc caa aat gtc ggc tta att aca 591
 Lys Asn Leu Lys Lys Val Gln His Thr Gln Asn Val Gly Leu Ile Thr
 80 85 90

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Lys Leu Ser Glu Ile Lys Lys Lys Tyr Leu Tyr Asp Leu Lys Val Asn	
95 100 105	
gtt tta tcg gaa gct gag ttg acg tca aaa aca aaa gaa aca aaa gaa	687
Val Leu Ser Glu Ala Glu Leu Thr Ser Lys Thr Lys Glu Thr Lys Glu	
110 115 120	
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Lys Leu Thr Ala Thr Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr	
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Glu Pro Glu Lys Lys Val Ala Glu Ala Gln Lys Lys Val Glu Glu Ala	
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Lys Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Arg Arg Asn Tyr Pro	
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acc att act tac aaa acg ctt gaa ctt gaa att gct gag tcc gat gtg	879
Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val	
175 180 185	
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Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala Lys Glu	
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Ser Gln Asp Glu Glu Lys Ile Lys Gln Ala Glu Ala Glu Val Glu Ser	
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Lys Gln Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu	
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Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys Glu Ala Val Glu Lys	
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Asn Val Ala Thr Ser Glu Gln Asp Lys Pro Lys Arg Arg Ala Lys Arg	
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Gly Val Ser Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala	
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Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser	
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Leu Asn Met Ala Asn Glu Ser Gln Thr Glu His Arg Lys Asp Val Asp	
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Glu Tyr Ile Lys Lys Met Leu Ser Glu Ile Gln Leu Asp Arg Arg Lys	
320 325 330	

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His Thr Gln Asn Val Asn Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr	
335 340 345	
aag tat ttg tat gaa tta agt gtt tta aaa gag aac tcg aaa aaa gaa	1407
Lys Tyr Leu Tyr Glu Leu Ser Val Leu Lys Glu Asn Ser Lys Lys Glu	
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gag ttg acg tca aaa acc aaa gca gag tta acc gca gct ttt gag cag	1455
Glu Leu Thr Ser Lys Thr Lys Ala Glu Leu Thr Ala Ala Phe Glu Gln	
365 370 375	
ttt aaa aaa gat aca ttg aaa cca gaa aaa aag gta gca gaa gct gag	1503
Phe Lys Lys Asp Thr Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu	
380 385 390 395	
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Lys Lys Val Glu Glu Ala Lys Lys Lys Ala Lys Asp Gln Lys Glu Glu	
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gat cgc cgt aac tac cca acc aat act tac aaa acg ctt gaa ctt gaa	1599
Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu	
415 420 425	
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Ile Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val	
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Lys Glu Glu Ala Asn Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Ala	
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Lys Glu Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys	
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Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala	
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Glu Glu Ser Glu Lys Lys Ala Ala Glu Ala Lys Gln Lys Val Asp Ala	
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Glu Glu Tyr Ala Leu Glu Ala Lys Ile Ala Glu Leu Glu Tyr Glu Val	
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Gln Arg Leu Glu Lys Glu Leu Lys Glu Ile Asp Glu Ser Asp Ser Glu	
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gat tat ctt aaa gaa ggc ctc cgt gct cct ctt caa tct aaa ttg gat	1983
Asp Tyr Leu Lys Glu Gly Leu Arg Ala Pro Leu Gln Ser Lys Leu Asp	
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acc aaa aaa gct aaa cta tca aaa ctt gaa gag ttg agt gat aag att	2031
Thr Lys Lys Ala Lys Leu Ser Lys Leu Glu Glu Leu Ser Asp Lys Ile	
560 565 570	
gat gag tta gac gct gaa att gca aaa ctt gaa gtt caa ctt aaa gat	2079

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			575					580					585			
gct	gaa	gga	aac	aat	aat	gta	gaa	gcc	tac	ttt	aaa	gaa	ggt	tta	gag	2127
Ala	Glu	Gly	Asn	Asn	Asn	Val	Glu	Ala	Tyr	Phe	Lys	Glu	Gly	Leu	Glu	
		590					595					600				
aaa	act	act	gct	gag	aaa	aaa	gct	gaa	tta	gaa	aaa	gct	gaa	gct	gac	2175
Lys	Thr	Thr	Ala	Glu	Lys	Lys	Ala	Glu	Leu	Glu	Lys	Ala	Glu	Ala	Asp	
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ctt	aag	aaa	gca	gtt	gat	gag	cca	gaa	act	cca	gct	ccg	gct	cct	caa	2223
Leu	Lys	Lys	Ala	Val	Asp	Glu	Pro	Glu	Thr	Pro	Ala	Pro	Ala	Pro	Gln	
620					625					630					635	
cca	gct	cca	gct	cca	gaa	aaa	cca	gct	gaa	aaa	cca	gct	cca	gct	cca	2271
Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Glu	Lys	Pro	Ala	Pro	Ala	Pro	
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gaa	aaa	cca	gct	cca	gct	cca	gaa	aaa	cca	gct	cca	gct	cca	gaa	aaa	2319
Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	
			655					660					665			
cca	gct	cca	gct	cca	gaa	aaa	cca	gct	cca	gct	cca	gaa	aaa	cca	gct	2367
Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	
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cca	act	cca	gaa	act	cca	aaa	aca	ggc	tgg	aaa	caa	gaa	aac	ggt	atg	2415
Pro	Thr	Pro	Glu	Thr	Pro	Lys	Thr	Gly	Trp	Lys	Gln	Glu	Asn	Gly	Met	
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tgg	tac	ttc	tac	aat	act	gat	ggt	tca	atg	gca	aca	ggc	tgg	ctc	caa	2463
Trp	Tyr	Phe	Tyr	Asn	Thr	Asp	Gly	Ser	Met	Ala	Thr	Gly	Trp	Leu	Gln	
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aac	aat	ggc	tca	tgg	tac	tac	ctc	aac	agc	aat	ggc	gct	atg	gcg	aca	2511
Asn	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ser	Asn	Gly	Ala	Met	Ala	Thr	
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gga	tgg	ctc	caa	aac	aat	ggc	tca	tgg	tac	tac	ctc	aac	agc	aat	ggc	2559
Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ser	Asn	Gly	
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gct	atg	gcg	aca	gga	tgg	ctc	caa	tac	aat	ggt	tca	tgg	tac	tac	ctc	2607
Ala	Met	Ala	Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	
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Asn	Ala	Asn	Gly	Asp	Met	Ala	Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	
		765				770					775					
tgg	tac	tac	ctc	aac	gct	aat	ggt	gat	atg	gcg	aca	gga	tgg	ttc	caa	2703
Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Asp	Met		Ala	Thr	Gly	Trp	Phe	
780					785					790					Gln	
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tac	aat	ggt	tca	tgg	tac	tac	ctc	aac	gct	aat	ggt	gat	atg	gcg	aca	2751
Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Asp	Met	Ala	Thr	
				800					805					810		
gga	tgg	ttc	caa	tac	aat	ggt	tca	tgg	tac	tac	ctc	aac	gct	aat	ggt	2799
Gly	Trp	Phe	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	

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gat atg gcg aca gga tgg ctc caa tac aat ggt tca tgg tac tac cta			2847
Asp Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu			
830	835	840	
aac agc aat ggt gct atg gta aca gga tgg ctc caa aac aat ggc tca			2895
Asn Ser Asn Gly Ala Met Val Thr Gly Trp Leu Gln Asn Asn Gly Ser			
845	850	855	
tgg tac tac cta aac gct aac ggt tca atg gca aca gat tgg gtg aaa			2943
Trp Tyr Tyr Leu Asn Ala Asn Gly Ser Met Ala Thr Asp Trp Val Lys			
860	865	870	875
gat gga gat acc tgg tac tat ctt gaa gca tca ggt gct atg aaa gca			2991
Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser Gly Ala Met Lys Ala			
880	885	890	
agc caa tgg ttc aaa gta tca gat aaa tgg tac tat gtc aat ggc tca			3039
Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly Ser			
895	900	905	
ggt gcc ctt gca gtc aac aca act gta gat agc tat aga gtc aat gcc			3087
Gly Ala Leu Ala Val Asn Thr Thr Val Asp Ser Tyr Arg Val Asn Ala			
910	915	920	
aat ggt gaa tgg gta aac taaacttaat ataactagtt aatactgact			3135
Asn Gly Glu Trp Val Asn			
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Phe	Ser	Ile	Gly	Val	Ala	Ser	Val	Ala	Val	Ala	Ser	Leu	Phe	Leu	Gly
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20

25

30

Gly	Val	Val	His	Ala	Glu	Gly	Val	Arg	Ser	Gly	Asn	Asn	Leu	Thr	Val
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Thr	Ser	Ser	Gly	Gln	Asp	Ile	Ser	Lys	Lys	Tyr	Ala	Asp	Glu	Val	Glu
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Ser	His	Leu	Glu	Ser	Ile	Leu	Lys	Asp	Val	Lys	Lys	Asn	Leu	Lys	Lys	
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Val	Gln	His	Thr	Gln	Asn	Val	Gly	Leu	Ile	Thr	Lys	Leu	Ser	Glu	Ile	
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Lys	Lys	Lys	Tyr	Leu	Tyr	Asp	Leu	Lys	Val	Asn	Val	Leu	Ser	Glu	Ala	
			100				105						110			
Glu	Leu	Thr	Ser	Lys	Thr	Lys	Glu	Thr	Lys	Glu	Lys	Leu	Thr	Ala	Thr	
		115					120					125				
Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	Leu	Pro	Thr	Glu	Pro	Glu	Lys	Lys	
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Val	Ala	Glu	Ala	Gln	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu	
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Asp	Gln	Lys	Glu	Lys	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys	
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Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala	
			180					185					190			
Glu	Leu	Glu	Leu	Val	Lys	Val	Lys	Ala	Lys	Glu	Ser	Gln	Asp	Glu	Glu	
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Lys	Ile	Lys	Gln	Ala	Glu	Ala	Glu	Val	Glu	Ser	Lys	Gln	Ala	Glu	Ala	
	210					215					220					
Thr	Arg	Leu	Lys	Lys	Ile	Lys	Thr	Asp	Arg	Glu	Glu	Ala	Lys	Arg	Lys	
225					230					235					240	
Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala	Val	Glu	Lys	Asn	Val	Ala	Thr	Ser	
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Glu	Gln	Asp	Lys	Pro	Lys	Arg	Arg	Ala	Lys	Arg	Gly	Val	Ser	Gly	Glu	
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Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Asn	Met	Ala	Asn	
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Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Arg	Arg	Lys	His	Thr	Gln	Asn	Val	
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Asn	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu	
			340					345					350			
Leu	Ser	Val	Leu	Lys	Glu	Asn	Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys	
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Thr	Lys	Ala	Glu	Leu	Thr	Ala	Ala	Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	
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 Ala Lys Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 405 410 415
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
 420 425 430
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Asn
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 Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Ala Lys Glu Lys Val Glu
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 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg
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 Gly Leu Arg Ala Pro Leu Gln Ser Lys Leu Asp Thr Lys Lys Ala Lys
 545 550 555 560
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 Lys Lys Ala Glu Leu Glu Lys Ala Glu Ala Asp Leu Lys Lys Ala Val
 610 615 620
 Asp Glu Pro Glu Thr Pro Ala Pro Ala Pro Gln Pro Ala Pro Ala Pro
 625 630 635 640
 Glu Lys Pro Ala Glu Lys Pro Ala Pro Ala Pro Glu Lys Pro Ala Pro
 645 650 655
 Ala Pro Glu Lys Pro Ala Pro Ala Pro Glu Lys Pro Ala Pro Ala Pro
 660 665 670
 Glu Lys Pro Ala Pro Ala Pro Glu Lys Pro Ala Pro Thr Pro Glu Thr
 675 680 685
 Pro Lys Thr Gly Trp Lys Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn
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Thr	Asp	Gly	Ser	Met	Ala	Thr	Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	705	710	715	720
Tyr	Tyr	Leu	Asn	Ser	Asn	Gly	Ala	Met	Ala	Thr	Gly	Trp	Leu	Gln	Asn	725	730	735	
Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ser	Asn	Gly	Ala	Met	Ala	Thr	Gly	740	745	750	
Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Asp	755	760	765	
Met	Ala	Thr	Gly	Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	770	775	780	
Ala	Asn	Gly	Asp	Met	Ala	Thr	Gly	Trp	Phe	Gln	Tyr	Asn	Gly	Ser	Trp	785	790	795	800
Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Asp	Met	Ala	Thr	Gly	Trp	Phe	Gln	Tyr	805	810	815	
Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ala	Asn	Gly	Asp	Met	Ala	Thr	Gly	820	825	830	
Trp	Leu	Gln	Tyr	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	Ser	Asn	Gly	Ala	835	840	845	
Met	Val	Thr	Gly	Trp	Leu	Gln	Asn	Asn	Gly	Ser	Trp	Tyr	Tyr	Leu	Asn	850	855	860	
Ala	Asn	Gly	Ser	Met	Ala	Thr	Asp	Trp	Val	Lys	Asp	Gly	Asp	Thr	Trp	865	870	875	880
Tyr	Tyr	Leu	Glu	Ala	Ser	Gly	Ala	Met	Lys	Ala	Ser	Gln	Trp	Phe	Lys	885	890	895	
Val	Ser	Asp	Lys	Trp	Tyr	Tyr	Val	Asn	Gly	Ser	Gly	Ala	Leu	Ala	Val	900	905	910	
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Asn

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 <212> PRT
 <213> Streptococcus pneumoniae

<400> 61
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 35 40 45

Thr	Ser	Ser	Gly	Gln	Asp	Ile	Ser	Lys	Lys	Tyr	Ala	Asp	Glu	Val	Glu		
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Ser	His	Leu	Glu	Ser	Ile	Leu	Lys	Asp	Val	Lys	Lys	Asn	Leu	Lys	Lys		
65					70					75						80	
Val	Gln	His	Thr	Gln	Asn	Val	Gly	Leu	Ile	Thr	Lys	Leu	Ser	Glu	Ile		
				85					90						95		
Lys	Lys	Lys	Tyr	Leu	Tyr	Asp	Leu	Lys	Val	Asn	Val	Leu	Ser	Glu	Ala		
			100					105					110				
Glu	Leu	Thr	Ser	Lys	Thr	Lys	Glu	Thr	Lys	Glu	Lys	Leu	Thr	Ala	Thr		
		115					120					125					
Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr	Leu	Pro	Thr	Glu	Pro	Glu	Lys	Lys		
130						135					140						
Val	Ala	Glu	Ala	Gln	Lys	Lys	Val	Glu	Glu	Ala	Lys	Lys	Lys	Ala	Glu		
145					150					155					160		
Asp	Gln	Lys	Glu	Lys	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys		
				165					170					175			
Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala		
			180					185					190				
Glu	Leu	Glu	Leu	Val	Lys	Val	Lys	Ala	Lys	Glu	Ser	Gln	Asp	Glu	Glu		
		195					200					205					
Lys	Ile	Lys	Gln	Ala	Glu	Ala	Glu	Val	Glu	Ser	Lys	Gln	Ala	Glu	Ala		
	210					215					220						
Thr	Arg	Leu	Lys	Lys	Ile	Lys	Thr	Asp	Arg	Glu	Glu	Ala	Lys	Arg	Lys		
225					230					235					240		
Ala	Asp	Ala	Lys	Leu	Lys	Glu	Ala	Val	Glu	Lys	Asn	Val	Ala	Thr	Ser		
				245					250					255			
Glu	Gln	Asp	Lys	Pro	Lys	Arg	Arg	Ala	Lys	Arg	Gly	Val	Ser	Gly	Glu		
			260					265					270				
Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser		
		275					280					285					
Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Asn	Met	Ala	Asn		
	290					295					300						
Glu	Ser	Gln	Thr	Glu	His	Arg	Lys	Asp	Val	Asp	Glu	Tyr	Ile	Lys	Lys		
305					310					315					320		
Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Arg	Arg	Lys	His	Thr	Gln	Asn	Val		
				325					330					335			
Asn	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu		
			340					345					350				
Leu	Ser	Val	Leu	Lys	Glu	Asn	Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys		
		355					360					365					

Thr Lys Ala Glu Leu Thr Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr
 370 375 380
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 385 390 395 400
 Ala Lys Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 405 410 415
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ala Glu Ser Asp Val
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 Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Asn Glu
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 Ser Arg Asn Glu Glu Lys Ile Lys Gln Ala Lys Glu Lys Val Glu Ser
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 Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys
 465 470 475 480
 Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Glu Glu Ser Glu Lys Lys
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 Ala Ala Glu Ala Lys Gln Lys Val Asp Ala Glu Glu Tyr Ala Leu Glu
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 Ala Lys Ile Ala Glu Leu Glu Tyr Glu Val Gln Arg Leu Glu Lys Glu
 515 520 525
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 Ser Lys Leu Glu Glu Leu Ser Asp Lys Ile Asp Glu Leu Asp Ala Glu
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 Ile Ala Lys Leu Glu Val Gln Leu Lys Asp Ala Glu Gly Asn Asn Asn
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 Val Glu Ala Tyr Phe Lys Glu Gly Leu Glu Lys Thr Thr Ala Glu Lys
 595 600 605
 Lys Ala Glu Leu Glu Lys Ala Glu Ala Asp Leu Lys Lys Ala Val Asp
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 Glu Pro Glu Thr Pro Ala Pro Ala Pro Gln Pro Ala Pro Ala Pro Glu
 625 630 635 640
 Lys Pro Ala Glu Lys Pro Ala Pro Ala Pro Glu Lys Pro Ala Pro Ala
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Lys Thr


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<213> Streptococcus pneumoniae
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Gly	Val	Val 35	His	Ala	Glu	Gly	Val 40	Arg	Ser	Gly	Asn	Asn 45	Leu	Thr	Val	
Thr	Ser 50	Ser	Gly	Gln	Asp	Ile 55	Ser	Lys	Lys	Tyr	Ala 60	Asp	Glu	Val	Glu	
Ser 65	His	Leu	Glu	Ser	Ile 70	Leu	Lys	Asp	Val	Lys 75	Lys	Asn	Leu	Lys	Lys 80	
Val	Gln	His	Thr	Gln 85	Asn	Val	Gly	Leu	Ile 90	Thr	Lys	Leu	Ser	Glu 95	Ile	
Lys	Lys	Lys	Tyr 100	Leu	Tyr	Asp	Leu	Lys 105	Val	Asn	Val	Leu	Ser 110	Glu	Ala	
Glu	Leu	Thr 115	Ser	Lys	Thr	Lys	Glu 120	Thr	Lys	Glu	Lys	Leu 125	Thr	Ala	Thr	
Phe 130	Glu	Gln	Phe	Lys	Lys	Asp 135	Thr	Leu	Pro	Thr	Glu 140	Pro	Glu	Lys	Lys	
Val 145	Ala	Glu	Ala	Gln	Lys 150	Lys	Val	Glu	Glu	Ala 155	Lys	Lys	Lys	Ala	Glu 160	
Asp	Gln	Lys	Glu	Lys 165	Asp	Arg	Arg	Asn	Tyr 170	Pro	Thr	Ile	Thr 175	Tyr	Lys	
Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala	
			180						185						190	
Glu	Leu	Glu 195	Leu	Val	Lys	Val	Lys 200	Ala	Lys	Glu	Ser	Gln 205	Asp	Glu	Glu	
Lys	Ile 210	Lys	Gln	Ala	Glu	Ala 215	Glu	Val	Glu	Ser	Lys 220	Gln	Ala	Glu	Ala	
Thr 225	Arg	Leu	Lys	Lys	Ile 230	Lys	Thr	Asp	Arg	Glu 235	Glu	Ala	Lys	Arg	Lys 240	
Ala	Asp	Ala	Lys	Leu 245	Lys	Glu	Ala	Val	Glu 250	Lys	Asn	Val	Ala	Thr 255	Ser	
Glu	Gln	Asp	Lys 260	Pro	Lys	Arg	Arg	Ala 265	Lys	Arg	Gly	Val	Ser 270	Gly	Glu	

Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser		
		275					280					285					
Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Asn	Met	Ala	Asn		
	290					295					300						
Glu	Ser	Gln	Thr	Glu	His	Arg	Lys	Asp	Val	Asp	Glu	Tyr	Ile	Lys	Lys		
305					310					315					320		
Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Arg	Arg	Lys	His	Thr	Gln	Asn	Val		
				325					330					335			
Asn	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu		
			340					345					350				
Leu	Ser	Val	Leu	Lys	Glu	Asn	Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys		
		355					360					365					
Thr	Lys	Ala	Glu	Leu	Thr	Ala	Ala	Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr		
	370					375					380						
Leu	Lys	Pro	Glu	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu		
385					390					395				400			
Ala	Lys	Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr		
				405					410					415			
Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ala	Glu	Ser	Asp	Val		
			420					425					430				
Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Asn	Glu		
	435						440					445					
Ser	Arg	Asn	Glu	Glu	Lys	Ile	Lys	Gln	Ala	Lys	Glu	Lys	Val	Glu	Ser		
	450					455					460						
Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	Lys	Ile	Lys	Thr	Asp	Arg	Lys		
465					470					475					480		
Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Glu	Glu	Ser	Glu	Lys	Lys		
				485					490					495			
Ala	Ala	Glu	Ala	Lys	Gln	Lys	Val	Asp	Ala	Glu	Glu	Tyr	Ala	Leu	Glu		
			500					505					510				
Ala	Lys	Ile	Ala	Glu	Leu	Glu	Tyr	Glu	Val	Gln	Arg	Leu	Glu	Lys	Glu		
		515					520					525					
Leu	Lys	Glu	Ile	Asp	Glu	Ser	Asp	Ser	Glu	Asp	Tyr	Leu	Lys	Glu	Gly		
	530					535					540						
Leu	Arg	Ala	Pro	Leu	Gln	Ser	Lys	Leu	Asp	Thr	Lys	Lys	Ala	Lys	Leu		
545					550					555					560		
Ser	Lys	Leu	Glu	Glu	Leu	Ser	Asp	Lys	Ile	Asp	Glu	Leu	Asp	Ala	Glu		
				565					570					575			
Ile	Ala	Lys	Leu	Glu	Val	Gln	Leu	Lys	Asp	Ala	Glu	Gly	Asn	Asn	Asn		
			580					585					590				
Val	Glu	Ala	Tyr	Phe	Lys	Glu	Gly	Leu	Glu	Lys	Thr	Thr	Ala	Glu	Lys		

595		600		605											
Lys	Ala	Glu	Leu	Glu	Lys	Ala	Glu	Ala	Asp	Leu	Lys	Lys	Ala	Val	Asp
610					615						620				
Glu	Pro	Glu	Thr	Pro	Ala	Pro	Ala	Pro	Gln	Pro	Ala	Pro	Ala	Pro	Glu
625					630					635					640
Lys	Pro	Ala	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala
				645					650					655	
Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala
			660					665				670			
Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu
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Lys	Pro	Ala	Pro	Ala	Pro	Lys	Pro	Glu	Thr	Pro	Glu	Thr			
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 <212> PRT
 <213> Streptococcus pneumoniae

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35 40 45
Ser Tyr Asn Lys Ala Asn Glu Ser Gln Thr Glu His Arg Lys Ala Ala
50 55 60
Lys Gln Val Asp Glu Asp Ile Lys Lys Met Leu Ser Glu Ile Gln Glu
65 70 75 80
Tyr Ile Lys Lys Met Leu Ser Glu Ile Gln Leu Asp Lys Arg Lys His
85 90 95
Thr Gln Asn Val Asn Leu Asn Arg Lys Leu Ser Ala Ile Gln Thr Lys
100 105 110
Tyr Leu Tyr Glu Leu Arg Val Leu Lys Glu Lys Ser Lys Lys Glu Glu
115 120 125
Leu Thr Ser Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu
130 135 140
Ile Ala Glu Phe Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val
145 150 155 160
Lys Glu Glu Ala Lys Pro Arg Asn Glu Glu Lys Ile Lys Gln Ala Lys
165 170 175
Ala Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Glu Ile

180					185					190					
Lys	Thr	Glu	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Glu
		195					200					205			
Glu	Ser	Glu	Lys	Lys	Ala	Ala	Glu	Ala	Lys	Gln	Lys	Val	Asp	Thr	Lys
		210					215					220			
Glu	Gln	Gly	Lys	Pro	Lys	Arg	Arg	Ala	Lys	Arg	Gly	Val	Ser	Gly	Glu
		225					230					235			240
Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser
				245					250					255	
Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Asn	Met	Ala	Asn
			260					265					270		
Glu	Ser	Gln	Thr	Glu	His	Arg	Lys	Asp	Val	Asp	Glu	Tyr	Ile	Lys	Lys
		275					280					285			
Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Arg	Arg	Lys	His	Thr	Gln	Asn	Val
		290					295					300			
Asn	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile	Lys	Thr	Lys	Tyr	Leu	Tyr	Glu
		305					310					315			320
Leu	Ser	Val	Leu	Lys	Glu	Asn	Ser	Lys	Lys	Glu	Glu	Leu	Thr	Ser	Lys
				325					330					335	
Thr	Lys	Ala	Glu	Leu	Thr	Ala	Ala	Phe	Glu	Gln	Phe	Lys	Lys	Asp	Thr
			340					345					350		
Leu	Lys	Pro	Glu	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu
		355					360					365			
Ala	Lys	Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr
		370					375					380			
Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ala	Glu	Ser	Asp	Val
		385					390					395			400
Lys	Val	Asp	Lys	Ala	Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Asn	Glu
				405					410					415	
Ser	Arg	Asn	Glu	Glu	Lys	Ile	Lys	Gln	Ala	Lys	Glu	Lys	Val	Glu	Ser
			420					425					430		
Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu	Glu	Lys	Ile	Lys	Thr	Asp	Asp	Arg
		435					440					445			
Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Lys	Ala	Glu	Glu	Ser	Glu	Lys
		450					455					460			
Lys	Ala	Ala	Glu	Ala	Lys	Gln	Lys	Val	Asp	Ala	Glu	Glu	Tyr	Ala	Leu
		465					470					475			480
Glu	Ala	Lys	Ile	Ala	Glu	Leu	Glu	Tyr	Glu	Val	Gln	Arg	Leu	Glu	Lys
				485					490					495	
Glu	Leu	Lys	Glu	Ile	Asp	Glu	Ser	Asp	Ser	Glu	Asp	Tyr	Leu	Lys	Glu

500					505					510					
Gly	Leu	Arg	Ala	Pro	Leu	Gln	Ser	Lys	Leu	Asp	Thr	Lys	Lys	Ala	Lys
		515					520					525			
Leu	Ser	Lys	Leu	Glu	Glu	Leu	Ser	Asp	Lys	Ile	Asp	Glu	Leu	Asp	Ala
		530					535					540			
Glu	Ile	Ala	Lys	Leu	Glu	Val	Gln	Leu	Lys	Asp	Ala	Glu	Gly	Asn	Asn
												555			560
Asn	Val	Glu	Ala	Tyr	Phe	Lys	Glu	Gly	Leu	Glu	Lys	Thr	Thr	Ala	Glu
				565					570					575	
Lys	Lys	Ala	Glu	Leu	Glu	Lys	Ala	Glu	Ala	Asp	Leu	Lys	Lys	Ala	Val
			580					585					590		
Asp	Glu	Pro	Glu	Thr	Pro	Ala	Pro	Ala	Pro	Gln	Pro	Ala	Pro	Ala	Pro
			595				600					605			
Glu	Lys	Pro	Ala	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro
			610				615					620			
Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Glu	Lys	Pro	Ala	Glu	Lys	Pro	Ala
												635			640
Glu	Glu	Pro	Ala	Glu	Lys	Pro	Ala	Pro	Ala	Pro	Glu	Lys	Pro	Ala	Pro
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Thr	Pro	Glu	Lys	Pro	Ala	Pro	Thr	Pro	Glu	Thr	Pro	Lys	Thr		
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<210> 64

<211> 437

<212> PRT

<213> Streptococcus pneumoniae

<400> 64

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			20					25					30		
Ser	Val	Val	His	Ala	Thr	Glu	Asn	Glu	Gly	Ser	Thr	Gln	Ala	Ala	Thr
			35				40					45			
Ser	Ser	Asn	Met	Ala	Lys	Thr	Glu	His	Arg	Lys	Ala	Ala	Lys	Gln	Val
			50			55					60				
Val	Asp	Glu	Tyr	Ile	Glu	Lys	Met	Leu	Ser	Glu	Ile	Gln	Leu	Asp	Arg
					70					75					80
Arg	Lys	His	Thr	Gln	Asn	Val	Ala	Leu	Asn	Ile	Lys	Leu	Ser	Ala	Ile
				85					90					95	
Lys	Thr	Lys	Tyr	Leu	Arg	Glu	Leu	Asn	Val	Leu	Glu	Glu	Lys	Ser	Lys
			100					105					110		
Asp	Glu	Leu	Pro	Ser	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Leu	Glu

115					120					125					
Leu	Glu	Ile	Ala	Glu	Phe	Asp	Val	Lys	Val	Lys	Glu	Ala	Glu	Leu	Glu
130						135					140				
Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Ser	Arg	Asn	Glu	Gly	Thr	Ile	Lys
145					150					155					160
Gln	Ala	Lys	Glu	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala	Thr	Arg	Leu
				165					170					175	
Glu	Asn	Glu	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu	Ala	Lys
			180					185					190		
Arg	Lys	Ala	Asp	Gly	Lys	Leu	Lys	Glu	Ala	Asn	Val	Ala	Thr	Ser	Asp
		195					200					205			
Gln	Gly	Lys	Pro	Lys	Gly	Arg	Ala	Lys	Arg	Gly	Val	Pro	Gly	Glu	Leu
210					215					220					
Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser	Ser	Asp	Ser	Ser
225					230					235					240
Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Ser	Ser	Leu	Lys	Ser	Gly	Lys	Lys
				245					250					255	
Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Glu	Lys	Lys	Ala	Lys
			260					265					270		
Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys
		275					280					285			
Thr	Leu	Asp	Glu	Leu	Glu	Ala	Glu	Ser	Asp	Val	Lys	Val	Lys	Glu	Ala
	290					295					300				
Glu	Leu	Glu	Leu	Val	Lys	Glu	Glu	Ala	Lys	Glu	Pro	Arg	Asp	Glu	Glu
305					310					315					320
Lys	Ile	Lys	Gln	Ala	Lys	Ala	Lys	Val	Glu	Ser	Lys	Lys	Ala	Glu	Ala
			325						330					335	
Thr	Arg	Leu	Glu	Asn	Ile	Lys	Thr	Asp	Arg	Lys	Lys	Ala	Glu	Glu	Glu
		340					345						350		
Ala	Lys	Arg	Lys	Ala	Ala	Glu	Glu	Asp	Lys	Val	Lys	Glu	Lys	Pro	Ala
		355					360					365			
Glu	Gln	Pro	Gln	Pro	Ala	Pro	Ala	Pro	Gln	Pro	Glu	Lys	Pro	Ala	Pro
	370					375					380				
Lys	Pro	Glu	Lys	Pro	Ala	Glu	Gln	Pro	Lys	Ala	Glu	Lys	Thr	Asp	Asp
385					390					395					400
Gln	Gln	Ala	Glu	Glu	Asp	Tyr	Ala	Arg	Arg	Ser	Glu	Glu	Glu	Tyr	Asn
			405					410						415	
Arg	Leu	Thr	Gln	Gln	Gln	Pro	Pro	Lys	Thr	Glu	Lys	Pro	Ala	Gln	Pro
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Ser	Thr	Pro	Lys	Thr											
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 <212> PRT
 <213> Streptococcus pneumoniae

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 35 40 45
 Ser Ser Gly Asp Glu Val Asp Glu Tyr Ile Lys Lys Met Leu Ser Glu
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 Ile Gln Leu Asp Lys Arg Lys His Thr His Asn Phe Ala Leu Asn Leu
 65 70 75 80
 Lys Leu Ser Arg Ile Lys Thr Glu Tyr Leu Tyr Lys Leu Lys Val Asn
 85 90 95
 Val Leu Glu Glu Lys Ser Lys Ala Glu Leu Thr Ser Lys Thr Lys Lys
 100 105 110
 Glu Val Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr Leu Lys Leu
 115 120 125
 Gly Glu Lys Val Ala Glu Ala Gln Lys Lys Val Glu Glu Ala Lys Lys
 130 135 140
 Lys Ala Lys Asp Gln Lys Glu Glu Asp His Arg Asn Tyr Pro Thr Asn
 145 150 155 160
 Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Lys Val
 165 170 175
 Lys Glu Ala Glu Leu Glu Leu Leu Lys Glu Glu Ala Lys Thr Arg Asn
 180 185 190
 Glu Asp Thr Ile Asn Gln Ala Lys Ala Lys Val Lys Ser Glu Gln Ala
 195 200 205
 Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu Gln Ala Glu
 210 215 220
 Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Glu Lys Ala Glu Glu
 225 230 235 240
 Ala Lys Arg Lys Ala Glu Ala Glu Glu Val Lys Asp Lys Leu Lys Arg
 245 250 255
 Arg Thr Lys Arg Ala Val Pro Gly Glu Pro Ala Thr Pro Asp Lys Lys
 260 265 270
 Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu
 275 280 285

Pro Ser Pro Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Gln Lys
 290 295 300
 Lys Val Ala Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp
 305 310 315 320
 Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ala
 325 330 335
 Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu
 340 345 350
 Glu Ala Lys Glu Ser Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala
 355 360 365
 Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys
 370 375 380
 Thr Asp Arg Lys Lys Ala Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu
 385 390 395 400
 Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Glu Lys Pro Thr Glu
 405 410 415
 Glu Pro Glu Asn Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu
 420 425 430
 Gln Pro Lys Ala Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu Asp Tyr
 435 440 445
 Ala Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro
 450 455 460
 Pro Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys Thr
 465 470 475

<210> 66
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 <212> PRT
 <213> Streptococcus pneumoniae

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 Ser Val Val His Ala Thr Glu Lys Glu Val Thr Thr Gln Val Ala Thr
 35 40 45
 Ser Phe Asn Lys Ala Asn Lys Ser Gln Thr Glu His Met Lys Ala Ala
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 Lys Gln Val Asp Glu Tyr Ile Thr Lys Lys Leu Gln Leu Asp Arg Arg
 65 70 75 80
 Lys His Thr Gln Asn Val Gly Leu Leu Thr Lys Leu Gly Val Ile Lys

			85					90					95				
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Glu	Leu	Pro 115	Ser	Glu	Ile	Lys	Ala 120	Lys	Leu	Asp	Ala	Ala 125	Phe	Glu	Gln		
Phe	Lys 130	Lys	Asp	Thr	Leu	Pro 135	Thr	Glu	Pro	Gly	Lys 140	Lys	Val	Ala	Glu		
Ala 145	Glu	Lys	Lys	Val	Glu 150	Glu	Ala	Lys	Lys	Lys 155	Ala	Glu	Asp	Gln	Lys 160		
Glu	Glu	Asp	Arg	Arg 165	Asn	Tyr	Pro	Thr	Ile 170	Thr	Tyr	Lys	Thr	Leu 175	Glu		
Leu	Glu	Ile 180	Ala	Glu	Ser	Asp	Val	Glu 185	Val	Lys	Lys	Ala	Glu 190	Leu	Glu		
Leu	Val	Lys 195	Glu	Glu	Ala	Lys	Gly 200	Ser	Arg	Asn	Glu	Gln 205	Lys	Val	Asn		
Gln	Ala 210	Lys	Ala	Lys	Val	Glu 215	Ser	Lys	Gln	Ala	Glu 220	Ala	Thr	Arg	Leu		
Lys 225	Lys	Ile	Lys	Thr	Asp 230	Arg	Glu	Gln	Ala	Glu 235	Ala	Thr	Arg	Leu	Glu 240		
Asn	Ile	Lys	Thr	Asp 245	Arg	Glu	Lys	Ala	Glu 250	Glu	Ala	Lys	Arg	Lys 255	Ala		
Glu	Ala	Glu	Glu 260	Val	Lys	Asp	Lys	Leu 265	Lys	Arg	Arg	Thr	Lys 270	Arg	Ala		
Val	Pro	Gly 275	Glu	Pro	Ala	Thr	Pro 280	Asp	Lys	Lys	Glu	Asn 285	Asp	Ala	Lys		
Ser	Ser 290	Asp	Ser	Ser	Val	Gly 295	Glu	Glu	Thr	Leu	Pro 300	Ser	Pro	Ser	Leu		
Lys 305	Ser	Gly	Lys	Lys	Val 310	Ala	Glu	Ala	Glu	Lys 315	Lys	Val	Ala	Glu	Ala 320		
Glu	Lys	Lys	Ala	Lys 325	Asp	Gln	Lys	Glu	Glu 330	Asp	Arg	Arg	Asn	Tyr 335	Pro		
Thr	Asn	Thr	Tyr 340	Lys	Thr	Leu	Glu	Leu 345	Glu	Ala	Glu	Ser	Asp 350	Val	Lys		
Val	Lys	Glu 355	Ala	Glu	Leu	Glu	Leu 360	Val	Lys	Glu	Glu	Ala 365	Lys	Glu	Ser		
Arg	Asn 370	Glu	Glu	Lys	Val	Lys 375	Gln	Ala	Lys	Ala	Glu 380	Val	Glu	Ser	Lys		
Lys 385	Ala	Glu	Ala	Thr	Arg 390	Leu	Glu	Lys	Ile	Lys 395	Thr	Asp	Arg	Lys	Lys 400		
Ala	Glu	Glu	Ala	Lys 405	Arg	Lys	Ala	Ala	Glu 410	Glu	Asp	Lys	Val	Lys 415	Glu		

Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys
 420 425 430
 Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala
 435 440 445
 Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu Asp Tyr Ala Arg Arg Ser
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 Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro Lys Thr Glu
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 Lys Pro Ala Gln Pro Ser Thr
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<210> 67
 <211> 451
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 67
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 35 40 45
 Ser Ser Asn Arg Ala Asn Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro
 50 55 60
 Lys Lys Leu Asp Ser Glu Arg Asp Lys Ala Arg Lys Glu Val Glu Glu
 65 70 75 80
 Tyr Val Lys Lys Ile Val Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys
 85 90 95
 Arg His Thr Ile Thr Val Ala Leu Val Asn Glu Leu Asn Asn Ile Lys
 100 105 110
 Asn Glu Tyr Leu Asn Lys Ile Val Glu Ser Thr Ser Glu Ser Gln Leu
 115 120 125
 Gln Ile Leu Met Met Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu
 130 135 140
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu
 145 150 155 160
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys
 165 170 175
 Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu
 180 185 190
 Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg
 195 200 205

Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro Lys Gly Arg Ala Lys Arg
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 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala
 225 230 235 240
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser
 245 250 255
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 260 265 270
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 275 280 285
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ala Glu Ser Asp Val
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 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu
 305 310 315 320
 Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser
 325 330 335
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 340 345 350
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 385 390 395 400
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 405 410 415
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 <211> 730
 <212> PRT
 <213> Streptococcus pneumoniae

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Thr	Ser	Ser	Gly	Asp	Glu	Val	Glu	Ser	His	Tyr	Gln	Ser	Ile	Leu	Glu		
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Lys	Val	Arg	Lys	Ser	Leu	Glu	Lys	Asp	Arg	His	Thr	Gln	Asn	Val	Asp		
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Leu	Ile	Lys	Lys	Leu	Gln	Asp	Ile	Lys	Arg	Thr	Tyr	Leu	Tyr	Asn	Leu		
				85					90					95			
Lys	Glu	Lys	Pro	Glu	Ala	Glu	Leu	Thr	Ser	Lys	Thr	Asn	Lys	Glu	Leu		
			100					105					110				
Asp	Ala	Ala	Phe	Glu	Lys	Phe	Lys	Lys	Glu	Pro	Glu	Leu	Thr	Lys	Lys		
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Leu	Ala	Glu	Ala	Glu	Lys	Lys	Ala	Lys	Asp	Gln	Lys	Glu	Glu	Asp	His		
	130					135					140						
Arg	Asn	Tyr	Pro	Thr	Asn	Thr	Tyr	Lys	Thr	Ile	Glu	Leu	Glu	Ile	Ala		
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Glu	Ala	Glu	Val	Gly	Val	Ala	Lys	Ala	Glu	Leu	Glu	Leu	Ala	Gln	Ala		
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Gln	Val	Gln	Ile	Pro	Gln	Asp	Thr	Glu	Lys	Ile	Asn	Ala	Ala	Lys	Ala		
			180					185					190				
Lys	Val	Glu	Ala	Ala	Lys	Ser	Asn	Val	Lys	Lys	Leu	Glu	Lys	Ile	Lys		
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Ser	Asp	Ile	Glu	Lys	Thr	Tyr	Leu	Tyr	Lys	Leu	Asp	Asn	Ser	Thr	Lys		
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Glu	Thr	Pro	Lys	Ser	Arg	Val	Arg	Arg	Asn	Ser	Pro	Gln	Val	Gly	Asp		
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Ser	Arg	Glu	Leu	Lys	Glu	Thr	Ile	Asp	Lys	Ala	Lys	Glu	Thr	Leu	Ser		
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Thr	Lys	Leu	Glu	Asp	Ala	Ser	Asp	Lys	Lys	Ser	Val	Glu	Asp	Leu	Arg		
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	305				310					315					320		
Arg	Glu	Lys	Glu	Asn	Gln	Pro	Ala	Pro	Gln	Pro	Gly	Gly	Gln	Ala	Gly		
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Gly	Ser	Met	Val	Val	Pro	Pro	Val	Thr	Gln	Thr	Pro	Pro	Ser	Thr	Ser		
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Gln Ser Pro Gly Gln Lys Ala Thr Glu Ala Glu Lys Lys Lys Leu Gln
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 370 375 380
 Thr Lys Thr Val Pro Asp Gly Ala Lys Leu Thr Gly Glu Ala Gly Lys
 385 390 395 400
 Ala Tyr Asn Glu Thr Arg Thr Tyr Ala Lys Glu Val Val Asp Lys Ser
 405 410 415
 Lys Lys Leu Leu Ser Gln Thr Ala Val Thr Met Asp Glu Leu Ala Met
 420 425 430
 Gln Leu Thr Lys Leu Asn Asp Ala Met Ser Lys Leu Lys Glu Ala Lys
 435 440 445
 Ala Lys Leu Val Pro Glu Val Lys Pro Gln Pro Glu Asn Pro Glu Pro
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 Lys Pro Gln Pro Glu Gly Glu Lys Pro Ser Val Pro Asp Ile Asn Gln
 465 470 475 480
 Glu Lys Glu Lys Ala Lys Leu Ala Ile Ala Thr Tyr Met Ser Lys Ile
 485 490 495
 Leu Asp Asp Ile Lys Lys His His Leu Lys Lys Glu Lys His His Gln
 500 505 510
 Ile Val Ala Leu Ile Lys Asp Leu Asp Lys Leu Arg Lys Gln Ala Leu
 515 520 525
 Ser Glu Ile Asp Asn Val Asn Thr Lys Val Glu Ile Glu Asn Thr Val
 530 535 540
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 545 550 555 560
 Gly Leu Ile Gln Asn Thr Pro Gln Val Pro Glu Ala Gln Arg Ala Gln
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 Arg Tyr Gln Arg Phe Gln Ile His Gln Lys Ala Pro Asp Thr Pro Gln
 580 585 590
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 595 600 605
 Pro Lys Ala Pro Asp Thr Pro Gln Val Pro Glu Ala Pro Lys Ser Pro
 610 615 620
 Glu Val Pro Lys Val Ser Asp Thr Pro Lys Ala Pro Asp Thr Pro Gln
 625 630 635 640
 Val Pro Glu Ala Pro Lys Ser Pro Glu Val Pro Lys Val Pro Glu Ala
 645 650 655
 Pro Lys Ala Pro Asp Thr Pro Gln Val Pro Glu Ala Pro Lys Ser Pro
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 Glu Val Pro Lys Val Pro Asp Thr Pro Lys Ala Pro Asp Thr Pro Gln

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Trp Lys Gln Glu Asn Gly Met Trp Lys Gly		
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 <211> 2349
 <212> DNA
 <213> Streptococcus pneumoniae

<400> 69

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gaaaagtaca	ttattcaatt	cgtaaattta	gtattggagt	agctagtgtg	gtagttgcta	240
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<211> 2405
<212> DNA
<213> Streptococcus pneumoniae

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<210> 71
<211> 2773
<212> DNA
<213> Streptococcus pneumoniae

<220>
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<222> (1)..(2773)
<223> nucleotide "n" can be any of the nucleotides "a",
"c", "g" or "t".

<400> 71
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<210> 72

<211> 2489

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 72

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aagaaaagta	cattattcaa	ttcgtaaatt	tagtattgga	gtagctagtg	tagctgttgc	300
cagcttggtc	ttaggaggag	tagtccatgc	agaaggggtt	agaagtggga	ataacctcac	360

ggttacatct	agtgggcaag	atatatcgaa	gaagtatgct	gatgaagtcg	agtcgcatct	420
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cggcttaatt	acaaagttga	gcgaaattaa	aaagaagtat	ttgtatgact	taaaagttaa	540
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aactttttgag	cagttttaaaa	aagatacatt	accaacagaa	ccagaaaaaa	aggtagcaga	660
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<210> 73

<211> 1680

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 73

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agaaaagtac	attattcaat	tcgtaaattt	agtattggag	tagctagtgt	agctgttgcc	300
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<210> 74

<211> 1766

<212> DNA

<213> Streptococcus pneumoniae

<220>

<221> misc_feature

<222> (1)..(1766)

<223> nucleotide "n" can be any of the nucleotides "a",
"c", "g" or "t".

<400> 74

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<210> 75

<211> 1590

<212> DNA

<213> Streptococcus pneumoniae

<400> 75

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ataaaaaaaa tgttgagtga gatccaatta gataaaagaa aacataccca caatttcgcc 360
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<210> 76

<211> 19

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: primer

<400> 76

cgacgaatag ctgaagagg 19

<210> 77

<211> 24

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: primer

<400> 77

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